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American Classification Gaining Recognition

SINCE the reorganization of the American Bureau of Shipping the encouraging outlook and revived interest shown in this undertaking not only by the older yards, but also by the yards recently established in the United States, gives ample assurance that the purposes and objects of the reorganization will be fully accomplished and that American classification of merchant tonnage will become a recognized standard at home and abroad.

During the past month the Bureau has classed over 25,000 gross tons of merchant shipping and has also inspected a large amount of tonnage to ascertain the general condition for the guidance of prospective purchasers and for various other purposes. Applications for inspections, for classifications and for comparisons of scantlings of proposed construction continue to be received from both the Atlantic and Pacific Coasts and from the Great Lakes and the Gulf, and a great majority of the new construction contracted for in these districts will be built in accordance with the requirements of and under the inspection of this Bureau.

The present activity and demands for the services of the American Bureau of Shipping have never before been equaled in the history of that organization, and the feeling of confidence of underwriters, shipowners and shipbuilders alike is well expressed in the continued applications for the Bureau's services.

American Shipping's Great Opportunity

AMERICAN shipping now has an opportunity such as England had fifty years ago, according to a report on Government Aid to Merchant Shipping, just made public by the Bureau of Foreign and Domestic Commerce. This opportunity, says the report, comes at a time when American citizens owning foreign built ships can operate them under the American flag, when interest in foreign trade is widespread, the necessity for foreign markets clearly recognized and the profitableness of shipping under present conditions is alluring.

No one conversant with shipping and foreign commerce has failed to recognize the immeasurable opportunities which fate has literally thrust at the door of American shipping during the past two years. Neither has anyone conversant with the navigation laws of the United States failed to recognize the barriers which have locked the door of American shipping to opportunity. It is true that American citizens owning foreign built ships can operate them under the American flag, and that some 625,000 tons of shipping have been added to the American merchant marine in this way. Eighty-four percent of this tonnage, however, was transferred to American registry shortly after the war broke out and less than sixteen percent has been added during the past year.

If American shipping is ever to seize the opportunity that has patiently been knocking at her door, the barriers of restrictive legislation must be let down so that American built and American manned ships can compete with the world's shipping and American capital attracted to her support.

Revival of Wooden Shipbuilding

AN interesting sequel of the unusual activity in the steel shipbuilding industry in this country is shown in a most remarkable revival of wooden shipbuilding. For a long period of years subsequent to the development of steel shipbuilding in the United States and elsewhere, the business of building wooden vessels gradually declined, as the steel vessels at the prevailing prices were a more desirable investment. Some six months ago, however, shipowners and those interested in having commodities transported by water, finding it impossible to have steel ships built for them with sufficient despatch to make them available, and further realizing the enormously high cost of steel construction, began to consider the advisability of building wooden ships, and the result has been a remarkable revival of the wooden shipbuilding industry.

As the necessary equipment for building wooden vessels is exceedingly simple as compared with the establishment required for steel construction, it was evident that the location of a wooden shipyard should be governed primarily by the lumber situation, and that other things being equal, wooden ships should be built where lumber could be most cheaply procured. Accordingly, while the established yards along the Maine coast have been given a number of contracts, and are still receiving more, a number of entirely new concerns have gone into the shipbuilding business, and in the Southern States this condition is particularly marked.

As an illustration, based merely upon the reports of one firm of designers in New York, Messrs. Cox & Stevens, we find that this concern has recently placed orders for eight large sailing vessels to be built in the South, and that they expect to place orders for at least as many more vessels within a short period of time. The vessels now building include four four-masted schooners, 236 feet by 40 feet by 19 feet (two at the yards of the Wilmington Shipbuilding & Marine Construction Company and two at the yards of the Savannah Engineering & Construction Company); two four-masted schooners, 221 feet by 41 feet 6 inches by 20 feet, and two four-masted schooners, 205 feet by 39 feet by 14 feet 3 inches, at the yards of the Brunswick Marine Construction Company. All of the above vessels are to be equipped with heavy oil engines of the Diesel or semi-Diesel type, and as their construction has been most carefully considered, the vessels are given a fifteen-year highest rate by the American Bureau of Shipping, which ensures reasonable rates of insurance. These vessels will be completed within about half the

period of time required for the construction of similar steel tonnage, and for about half the first cost.

An interesting feature of wooden shipbuilding as now carried on is that the vessels are now carefully designed by competent naval architects, and are not merely built by rule of thumb and copied after some previous vessel, as was formerly the case. The naval architect has, of course, at his disposal models of successful vessels that have been built, and by combining this information with his own knowledge a material improvement in the designing and earning capacity of any vessel is certain to be secured.

Naval Preparedness—The British Fleet

BY BERNARD A. SINN

The wonderful military efficiency of the Teutonic armies has been the study of all military and naval experts the world over. England, as far as possible, is applying her analysis of the German army organization to the development of her navy, and from the experience gained, since the beginning of the war, has finally decided on an offensive fleet formation, a fleet of high speed, vast offensive strength, complete within itself, and mobile to a degree hitherto unthought of.

The general tactical units of fleet, division and squadron are still undisturbed, but the assignment of vessels to these units is different from anything attempted before.

The offensive fleet consists of two divisions of three squadrons each. Every division is composed of two squadrons of battleships and one squadron of battle cruisers, a total of six fighting units of four vessels each, or sixteen battleships and eight battle cruisers.

Each squadron of battle cruisers has attached to it the scout cruisers of the division, one for each battleship in the division. The scout cruisers now building or recently completed for Great Britain are large, high speed vessels of over 30 knots sea speed, and capable of long voyages. In addition to the eight scout cruisers attached to each battle cruiser squadron a new type of destroyer has been built, and eight of these are attached to the battle cruiser squadron. These scout destroyers are of 1,800 tons displacement and about 35 knots sea speed.

The battle cruiser, or fast mobile, part of each division consists of four battle cruisers, eight scout cruisers and eight scout destroyers, all basing on the battle cruisers, all of 30 knots speed and of the greatest mobile effectiveness. To each battle cruiser there are also attached repair ships, ordnance and store ships and eight fuel ships. The auxiliaries have equal speed to the capital ships and are able to accompany this mobile squadron, and form part of a complete and harmonious unit of the highest speed.

The main, or fighting, squadrons are composed of battleships, destroyers and submarines. A division consists of two squadrons of four battleships each. These vessels are of the largest and most powerful type afloat, the latest being designed for 24 knots sea speed. To each squadron of four battleships there are assigned sixteen destroyers and sixteen fleet submarines. The destroyers are boats of from 1,000 to 1,250 tons displacement and 28 to 30 knots speed, and the submarines are of the largest types, the latest being over 20 knots speed and able to maneuver with the fleet.

The fighting vessels of the fleet are as follows:

Eight battle cruisers, 12 battleships, 16 scout cruisers, 16 scout destroyers, 32 fleet destroyers, 32 submarines.

In order to make such a fleet still more effective, particular stress has been paid to the auxiliary vessels, and over 100 vessels of different types have been assigned to the fleet. Each division has one hospital ship, one submarine repair ship, one ship for machinery and electrical repairs and one general repair vessel. For each squadron there are provided one food supply ship, one refrigerator ship, two ammunition ships, eight colliers and four high-speed seagoing towboats. The latter are used to handle disabled boats, to assist the slower vessels, when necessary, to act as dispatch boats, and as fire and wrecking boats, for which purpose they are especially fitted with large pumps and derricks.

A complete fleet will have as auxiliaries the following:

Two hospital ships, 10 repair ships, 10 supply ships, 10 ammunition ships, 48 fuel ships, 16 towboats or dispatch boats. A total of 96 vessels of all kinds.

To man this enormous fleet requires 80 officers and 1,200 men for each capital ship, each scout takes 32 officers and 400 men, each destroyer 5 officers and 130 men, each submarine 3 officers and 20 men. The auxiliaries, in addition to their regular complements, carry a large reserve of both officers and men, in order to keep the fighting ships fully supplied with full crews. The foregoing clearly indicates the huge number of men required for a fleet in war times, a total of over 4,000 officers and 50,000 men.

The early months of this present war demonstrated that the officers and men on small craft, such as submarines and destroyers, are constantly breaking down under the severe mental and physical strain to which they were subjected. In order to avoid this as much as possible, the officers and men are supplied from the capital ships of their respective squadrons and 48 hours is now the limit of service on the small boats. Daily changes are made when practicable, and in this way officers are only required to do duty on the smaller ships on the average of one day in six. Constant shifts are also made from the capital ships to the auxiliaries and vice versa, so that the high tension under which both officers and men are working may be relieved as much as possible. As the drills on large ships are continuous, a week on a collier would seem like a vacation to the tired officers and men.

Let us glance at the formation of this tremendous fleet. The sixteen scout destroyers, using the scout boats as a base would advance from 25 to 30 miles ahead of the scouts with a distance of 5 to 10 miles between each vessel, thus effectively covering 200 to 300 miles and converging on a battle cruiser as a base. The battle cruisers are at a distance of 10 to 20 miles from the support to the scouts. From 10 to 15 miles in the rear of the battle cruisers would be the battleships in squadron formation, ready to support the battle cruisers, and flanked by the destroyers and supported by the submarines. At the approach of an enemy, the advance scouts would retire to the rear, the battle cruisers would form the first attack until the battleships arrive, when they would form the rear guard ready to dash out to the support of any weak unit, or to pursue an escaping enemy's ship, or to attempt a flank maneuver. Meanwhile the torpedo boats and submarines would act as the commander of each battle squadron directs, either to make a heavy pall of smoke to disguise fleet maneuvers, or as a screen for submarine operations. At the same time the battle cruisers, with their tremendous speed, may attempt to gain the rear of the attacking ships, cutting off their retreat and taking up a raking position and still further embarrassing the enemy.

Even a casual glance at this tremendous fleet organization shows that an attacking force would have no chance unless it were of equal numerical strength, equal speed and effectiveness. The mobility, power and

strength of this fleet can hardly be estimated, with its 50,000 men, 4,000 officers, 360 to 400 guns of the heaviest caliber, homogeneity in every detail, self-contained and self-sustaining, and the inevitable sea battle, which must come sooner or later, will show the wisdom of such an organization.

Great Britain has three such fleets prepared and a fourth under construction and with the present rapidity of work in the dockyards and private plants, is able to completely equip and construct a fleet such as is herein described in fourteen months.

How futile our own efforts in the direction of naval preparedness seem when compared to those of other nations! Each of Great Britain's great offensive fleets contains more fighting ships, more auxiliaries, more officers and more men than the entire naval establishment of the United States. We have at present in commission only five ships of the first class, and in a battle fleet sixteen are required. All other battlships in commission in our navy are only good for coast defense or training purposes. We have no battle cruisers, we have no scout cruisers, we have no large scout destroyers, no large submarines. In other words, as an offensive fleet the United States has one battle squadron with the necessary destroyers and nothing else. As for officers and men, probably two squadrons could be effectively manned and enough auxiliaries be gathered together sufficient for one squadron. All the warnings of our General Board have gone unheeded for years. Although nearly $700,000,000 (£143,740,000) have been spent on our naval establishment in the last five years, we are unable to supply the necessary vessels for a division, let alone a fleet.

When will the people of this great country learn the lessons that are being taught daily in Europe, and when will useless political waste give way to proper economical preparedness?

[Note: The information herein contained, while derived from trustworthy sources, is not official.]

Shipbuilding on the Columbia River

With a shipyard at St. Helen, Ore., just below the city of Portland, engaged in the construction of two vessels of the type of the *City of Portland,* launched recently and described in our last issue, with work proceeding on construction of four steel ships at the yards of the Willamette Iron Works and the Northwest Steel Company, with a dredger at work at the docks of the Peninsula Lumber Company, preparing for the establishment of a shipyard by F. C. Knapp, with the Motorship Construction Company incorporated and pushing plans for a ship construction plant at Vancouver, Wash., across the Columbia River from Portland, and with two vessels under way at Astoria, near the mouth of the Columbia River, Portland and the Columbia River basin are entering on an era of shipbuilding that will restore a large number of wooden vessels to the commerce of the seas.

At St. Helen the John R. McCormick Company is operating and has turned out a vessel that seems to be accepted as a pioneer of a new order. The type is being adopted by most of the other yards and is a combination of sail and auxiliary power which gives a larger offshore radius of action and safeguards against the delays that were formerly experienced by sailing craft.

In all sections of the West it is believed that the wooden ship is coming back and that if the era shall be short-lived as compared with former days it will be of sufficient duration to warrant the investment in the business at this time. Many financiers are of the opinion that because of the cheap construction and the tremendous forests that are available on the Columbia River the wood bottoms will never again go out.

Using the *City of Portland,* recently launched, as the type of vessel which all the yards are endeavoring to duplicate, a description would be as follows:

Single decker; length, 278 feet; beam, 48 feet; depth, 19.6 feet; gross tonnage, 1,750; net tonnage, 1,671; lumber capacity, 2,000,000 feet.

Her power consists of a 7,000 square yard spread of sail and a pair of semi-Diesel engines, each unit developing 320 horsepower. The fuel is "caloil," a product of the California oil fields which costs $1 (4/2) per barrel. The estimated cost of operating both engines for twenty-four hours will be $20 (4/3/4), or 20 barrels. A speed of 8 knots is expected when running without sails or in a dead calm. The two methods may be combined and the speed greatly enhanced. The plan of the operators is to use sail exclusively when winds are sufficiently strong, so that the cost of operation may be reduced to a minimum.

In the construction of the *City of Portland,* 1,200,000 feet of Oregon fir was used. The cost is divided as follows:

Labor	$40,000
Lumber	30,000
Iron and spikes	15,000
Oakum, rigging, supplies, etc.	15,000
Engines and installation	50,000
	$150,000 (£30,700)

Shipbuilders at Portland estimate that a steel vessel of similar size and power would cost $35,000 (£71,750) at this time of high prices, while under normal prices it would cost $250,000 (£51,250).

While operating costs are problematical, careful estimates of costs by the owners indicate that a vessel of class of the *City of Portland* may be operated for $3,500 (£718) per month. This includes $1,200 (£246) as wages, $750 (£154) for insurance at 6 percent, and $600 (£123) for fuel. Experienced operators are of the opinion that the engines need be kept running not more than one-fourth of the time, and that the cost of fuel may be reduced to a maximum of $150 (£31) per month. Interest is figured at $870 (£178) per month, while upkeep will not be higher than on wood vessels of ordinary type. Depreciation is problematical, as the semi-Diesel engine has not been long enough in use to establish a record of facts.

The *City of Portland* went into commission this month, and has already been chartered for three trips to Australia. She will earn enough on those voyages to pay for herself.

If the new era shall be permanently established, it is probable that the Columbia River will witness a very rapid development of the shipbuilding industry because of the close proximity of enormous quantities of suitable timber. It is conservatively estimated that 200,000,000 feet of such timber can be secured from the Columbia and its tributaries and floated to the yards. Sticks of 150 feet in length are not rare, but, on the contrary, are very ordinary pieces of timber in these forests. Certain it is that in no other part of the world can as many advantages of material and water frontage be had as along the Columbia.

Steel Ships Under Construction

Material is now arriving at Portland for the construction of the steel ships referred to above. They are to be 429 feet long over all, 54 feet beam, 29 feet molded depth, and are to have an average speed of 11½ knots. They are to cost $1,000,000 (£205,000) each and are for Norwegian owners. All are to be used as tramp freighters.

Economic Marine Propulsion

BY THOMAS J. ROGERS

The purpose of this article is to ascertain the relations which, in steamship propulsion, exist between the speed of the ship and the fuel which must be consumed to obtain that speed; and also to find the most econmoical rate at which that vessel can proceed.

It must be conceded that the most obvious and the most conclusive method is to try the ship at all desirable speeds; but the expense in time, labor and money is prohibitive; therefore a satisfactory method for calculating these matters, in these days of large ships and large coal bills, has become a necessity.

Ordinarily speaking, the power required to propel a ship at any speed varies with the cube of that speed, and, incidentally, with the cube of the revolutions of the propeller which produces the speed. But the ratio between the speed of the ship and the revolutions of the propeller varies greatly with the weather; thus with a very strong head wind the revolutions may be great and the speed almost nothing. For this, and for many other reasons, the revolutions, rather than the speed, will be used as a basis for calculation.

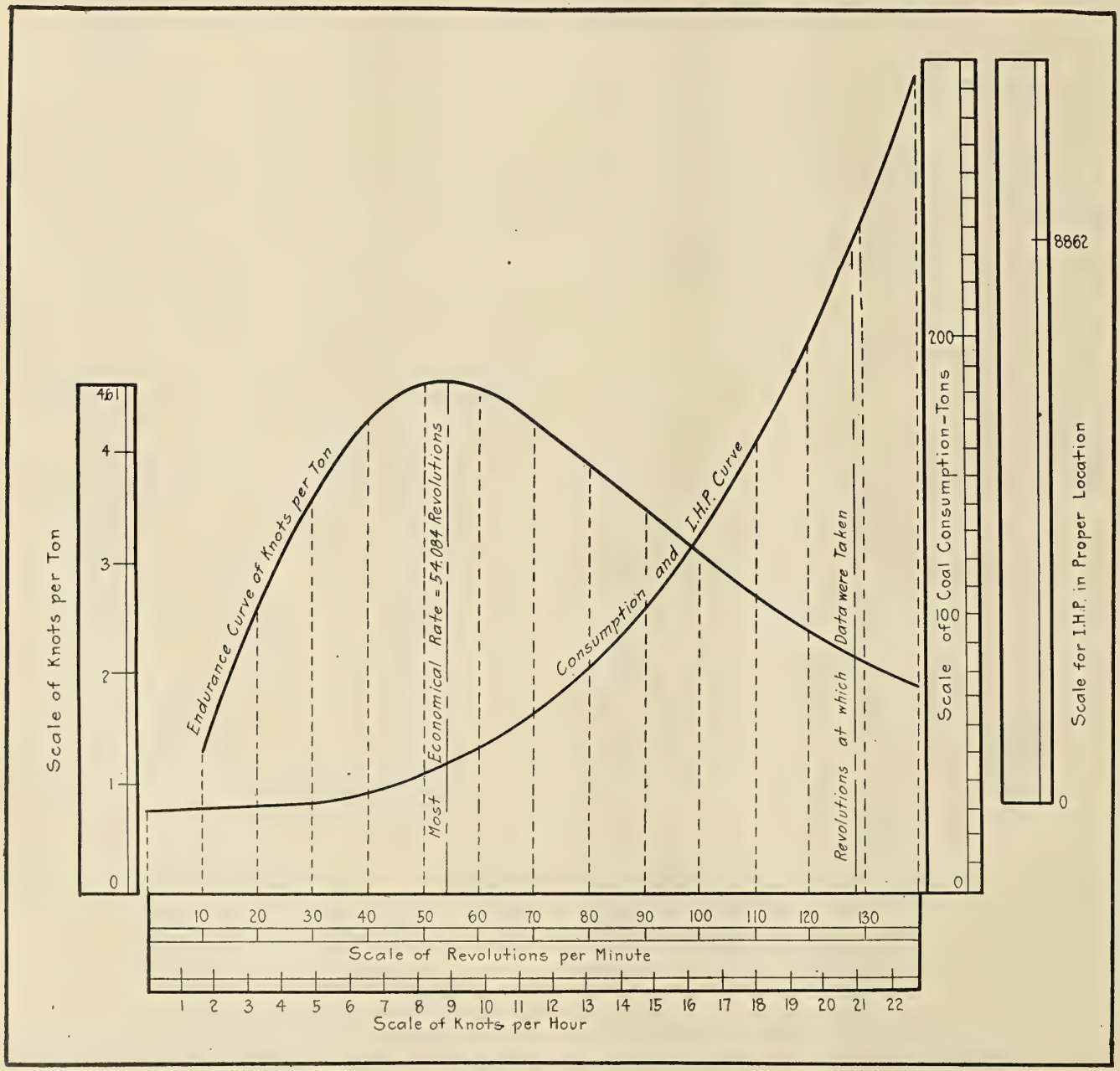
There are two standpoints from which to study this question:

First. A vessel, as for instance a vessel of war, having a certain amount of coal on board, may desire economic propulsion, in order to make her coal carry her as far as possible. She would therefore proceed at such a rate as to make each knot cost as little as possible in coal or, in other words, she would seek economy in fuel.

Second. A merchantman, however, would seek economy of a commercial kind. She would, therefore, proceed at such a rate as to make each knot cost as little as possible in money; or, in other words, she would seek economy in money.

Consider economy in fuel first.

It is easy to understand, whether a vessel proceeds fast or slow, or even if stopped altogether, that a certain quantity of coal must be consumed to supply auxiliary power and to maintain the temperatures of boilers, pipes,


Scale of Knots per Ton
4.61
4
3
2
1
0
Endurance Curve of Knots per Ton
Most Economical Rate = 54.084 Revolutions
Consumption and I.H.P. Curve
Revolutions at which Data were Taken
Scale of 100 Coal Consumption-Tons
200
0
8862
Scale for I.H.P. in Proper Location
0
10 20 30 40 50 60 70 80 90 100 110 120 130
Scale of Revolutions per Minute
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22
Scale of Knots per Hour

Performance Curves of Large Ocean-Going Liner

cylinders and other hot surfaces, and that this quantity is not a variable, but is a constant quantity, amounting to q tons per 24 hours. To this must be added the real cost of propulsion, which, at the rate of one revolution per minute, amounts to k tons, and at the rate of R revolutions, to $k R^3$ tons per 24 hours.

Within this time unit, therefore, the total quantity consumed will be:

$$Q = (q + k R^3) \qquad (1)$$

At the rate, therefore, of R revolutions, the cost per day of each revolution is

$$\frac{Q}{R} = U = \frac{q + k R^3}{R} \qquad (2)$$

If now

$$\frac{d U}{d R} = \frac{3 k R^3 - q - k R^3}{R^2}$$

be placed $= O$.

then

$$R = \left(\frac{q}{2 k}\right)^{1/3} \qquad (3)$$

and is the most economical rate possible

To obtain the constants q and k it is necessary to try the ship at two different rates, viz., at R and at R_1 revolutions from which is derived $Q = (q + k R^3)$ and $Q_1 = (q + k R^3_1)$ and therefore

$$k = \left(\frac{Q - Q_1}{R^3 - R^3_1}\right) \text{ and } q = (Q - k R^3) \qquad (4)$$

By the above method, therefore, three most useful equations are obtained.

By (1) a curve is plotted showing coal consumption at all possible speeds.

By (2) a curve of endurance is plotted for all possible speeds.

By (3) the economic speed is found direct.

To apply the above method to merchantmen, it is only necessary in these equations to substitute for the coal in tons its value in money, and to add to the constant q other constant expenses in money, such as keep of passengers, interest, insurance and so forth. Since in the case of merchantmen q must be increased, a curious corrollary arises, viz., the economic speed of a merchantman is greater than that of a man-of-war.

What has thus far been written is substantially the original method, which may be called the rigid method, to distinguish it from what follows, which may be called the provisional method.

Experience demonstrates that under the circumstances usually attending the trials of new ships it is well nigh impossible to obtain correct data for more than one rate of speed. Nevertheless it is highly important to have some idea of what the future performance of that ship will be. To meet this difficulty the following method of finding the values of q and k from one trial only has been devised. It is based upon the fact that since there is a constant quantity of q tons consumed, even though the ship is stopped, therefore the power unit, within the time unit, costs m times more at the lower than at the higher speeds.

Let R = revolutions at which data are taken.
R_1 = revolutions at the economic rate.
$Q = a \times (\text{I. H. P.})_1$ = total coal per day at R revolutions.
$Q_1 = ma \times (\text{I. H. P.})_1$ = total coal per day at R_1 revolutions.

Let also $(I.\ H.\ P.) = b R^3_1$.

Then

$$a = \left(\frac{q + k R^3}{b R^3}\right), ab = \left(\frac{q + k R^3}{R^3}\right)$$

and similarly

$$m a b = \left(\frac{q + k R^3_1}{R^3_1}\right)$$

But by equation (3)

$$R^3_1 = \frac{q}{2 k}; \text{ therefore } mab = 3 k \qquad (5)$$

Into (5) restoring the values

$$a = \frac{Q}{\text{I. H. P.}} \text{ and } b = \frac{\text{I. H. P.}}{R^3}$$

Then

$$k = \frac{m Q}{3 R^3} \text{ and } q = Q - k R^3. \qquad (6)$$

Now all of the above values are to be found in the data of one trial, except the value of m, which must be assumed; and because this method depends on an assumption, therefore it is called provisional.

But this value may be derived from trials with other ships, and the results obtained by this method are more accurate than when taken from data in the least degree doubtful; in proof of which are given in the illustration herewith the performance curves of a large ocean liner, calculated from the value of m found from data taken from only a fair size coastwise vessel, than which two more dissimilar vessels could scarcely be imagined.

The American Merchant Marine

BY FRANK J. NOLAN

Restoration of the American merchant marine is not the concern of any one political party, nor of any particular interest or set of individuals, nor of any one section of our country; it is a national issue of the most vital importance to every man, woman and child in the United States to-day.

No nation has ever become truly great or become an important factor in international affairs or foreign commerce unless it has been great on the seas. There is no question in my mind but that the United States cannot hope to reach its full growth and measure of progress until its shipping and commerce are relatively equal to its industries on land. Soon after its birth our nation was in dire distress. Foreign ships had flooded the country with foreign manufactures of all kinds. The products exported from this country were not sufficient to pay for our imports. The country was swept of its specie and the national debt had begun to grow. Skilled labor could find no employment and want and misery prevailed. The very independence of the new republic seemed to mock the people who now faced famine with all its ravages and horror.

But our first Congress, meeting in the year 1789, changed things immediately. The first boost given to the merchant marine of America was administered by Congress when it passed a tariff act which Washington signed on July 4, 1789. This act contained the first declaration of maritime independence. This law provided a ten per cent reduction in duty on imports in American vessels and was so arranged as greatly to favor American ships in the carriage of tea from the different ports of the Orient. It goes without saying that the adoption of this tariff tremendously stimulated home production. The diversification of industries soon afforded profitable employment for everybody. Our specie returned, manufactures flourished, shipbuilding grew by leaps and bounds, prosperity was restored and the well-being of the new republic once more was assured.

Previous to the adoption of our first tariff but 23.8

percent of the imports and exports of the United States was carried in American ships. A few years later, under the new law, American ships were carrying 90 percent. The loss of revenue caused by the discount of 10 percent in the duty on imports in American ships actually embarrassed the government. The act therefore was amended, and instead of a reduction of duty in favor of American ships an increase of 10 percent was imposed on all imports in foreign ships. Following this action for a period of about thirty-five or forty years, American ships carried on an average of nearly 90 percent of the foreign commerce of the United States. In 1826 they carried as much as 92.5 percent. This, as far as I can ascertain, was the largest proportion ever borne under the American flag in any one year. Who of our forefathers at that time even dreamt that we would to-day be in such a humiliating position as we are in regard to our merchant marine?

Foreign Commerce Carried in American Ships

For the information of those not conversant with the merchant marine of their country, I give the following table showing the commerce carried on American ships from the year 1789 to the year 1914. These figures, as anyone can see, are not anything to be in any way proud of:

	Percent		Percent
1789	23.8	1860	66.2
1795	90.0	1870	35.6
1800	89.0	1880	17.4
1810	91.5	1890	12.9
1820	89.5	1900	9.3
1830	89.9	1910	8.8
1840	82.9	1914	9.7
1850	72.5		

These figures speak for themselves and show without a doubt the appalling state of our merchant marine to-day in comparison with former years. When one considers that about seventy years ago American ships carried nearly 90 percent of the commerce of the country and to-day are carrying less than 10 percent, one has to stop and think what has happened to the merchant marine of America to-day.

It is a most remarkable thing that while our imports and exports have grown to immense proportions, our merchant marine has dwindled to an almost negligible figure. From $71,670,735 (£14,700,000) in 1830, exports have increased to $2,364,579,184 (£485,000,000) in 1914, and imports for the same number of years have increased from $62,360,956 (£12,800,000) to $1,893,925,657 (£388,000,000). The United States to-day produces 50 percent more than she can consume and it is only natural that we must and ought to have an outlet for our overflow of produce. It is very true we have an outlet for our products, but at what an awful cost to our producers and manufacturers!

How do we transport our products and get them on the foreign markets of the world? How do we compete with foreign countries who have vast merchant marines three times the size of ours? Under the present conditions we have to go to foreign shippers and ask them to transport our products to foreign markets for us, as we haven't got a merchant marine to do it with. Is it not a disgrace and a shame that a great country like the United States to-day has to humble herself and go and ask a foreign nation to carry her goods for her so that we may in a way get our products on the foreign markets and thereby compete in the world's commerce?

We not only have to get a foreign shipper to take our products over the ocean for us, but naturally we have to pay *his* price, whatever the prevailing freight rates may happen to be at that particular time. His freight rates are by no means low, and we thereby have to stand for a severe cut into our profits, which in plain words is making a millionaire out of the foreign shipper at our expense. At the present time we haven't a single ship that can compare favorably with the giant *Mauretania, Olympic, Aquitania,* or *Vaterland,* whose tonnage varies from 40,000 to 50,000 each.

For five months in the year American tourists pour in a steady stream into Europe, going and coming back on foreign ships because there are no other ships to take them, at least no American ships flying the American flag. In this one instance alone are not millions of American dollars flowing into the pockets of foreign shipping companies which, if we had a fleet of American-owned and American-built ships, could be diverted into the pockets of American shipowners and thereby keep the vast millions of dollars now going out of the country in the country? I haven't the slightest doubt but that if the American public were to educate themselves in matters pertaining to the merchant marine of the country they would open their eyes to the fact that we are in a sorry plight for a country of our size. There are millions of people in this country who do not know anything of or have never seen the merchant marine of this country, and who, until the matter has been laid before them in a plain and unvarnished way, cannot be expected to know much about the thing that is the very life's blood of every maritime nation—namely, its merchant marine.

Our overseas shipments during the twenty-year period ending 1895 amounted to something like $28,000,000,000 (£5,750,000,000). Of this total American ships carried 17 percent and foreign ships 83 percent. Ocean freights in normal times average about 6 percent of the value of the goods shipped; but at the present time the prevailing rates are away above this mark, and much to our regret American shippers are only getting a very small share of what they ought to be getting. In 1914 the rates rose to 13.6 percent, but on a basis of only 6 percent it cost the United States over $1,500,000,000 to have its freight transported so that we could get in on the foreign markets. This figure is for the last twenty years. Of this amount the United States earned only $285,000,000 (£58,500,000), while foreign ships earned something like $1,500,000,000. This is another flaring example of our lack of a merchant marine.

Earnings of American and Foreign Ships

Our total overseas commerce for the twenty years just ended amounted to nearly $50,000,000,000, which is an increase of 78.3 percent over the previous twenty years. In the carrying of this commerce American ships earned something less than $300,000,000 (£61,600,000) and foreign ships more than $2,500,000,000. Should America stand still for the next twenty years as regards her merchant marine, it is not very hard to see what the result would be to America at the end of that time.

The average life of a ship is twenty years, and according to Lloyd's reports the present world's tonnage of ships (in excess of 100 tons) is 49,089,552. Under normal conditions $500,000 (£102,500) will build a 5,000 ton ship. On this basis we have bought and paid for during the past twenty years, in freight charges alone, the equivalent of 26,965,692 tons, or more than half the world's tonnage to-day, and we stand ready during the coming twenty years, unless we wake up from the present lethargy, to replace this worn-out tonnage with new ships equal on this basis to 48,088,589 tons, all a gift to foreign nations. History proves that no country not endowed with maritime power and ability has ever risen to first importance. History has also proved that no nation can hope to reach the pinnacle of commercial importance and success unless it controls the transportation of its exports from the pro-

ducer to the customer and the banking, exchange and insurance transactions which accompany that commerce.

There is close affinity between land industries and overseas commerce. The development of the latter has direct bearing upon the employment of both labor and capital, and where a nation has no ships that development becomes correspondingly difficult. Irregularity of employment is a curse to which poverty and discontent are the sequel. With us in America it is either a feast or a famine. Employment of capital goes hand in hand with employment of labor, and continuous employment for both is essential to our industrial welfare and progress. Demand regulates activity in all manufacturing institutions. When demand is less than capacity, factories must either run on short hours or else close down entirely from time to time, and when this condition obtains both labor and capital suffer, the cost of the factory production increases and there is corresponding decrease in our ability to compete with foreign nations for the world's trade.

Foreign Markets a Necessity

In many lines of manufacture production outstrips consumption, and notwithstanding the tremendous absorptive powers of the United States our manufacturers in many lines are to-day face to face with this condition of output exceeding demand. Since our home markets are inadequate, we must, perforce, find foreign markets which will take our surplus goods from us in order that the development of our industries may flow along uninterruptedly and both labor and capital find continuous and profitable employment.

At the present time we export about 5 percent, or one-twentieth, of our manufactured goods, whereas in normal times England and Germany export respectively 55 and 45 percent. I should estimate that the commercial census will show for this year that this yearly production has grown to the enormous total of $25,000,000,000 (£5,125,000,000). If we should develop our foreign trade possibilities to the fullest extent, which I know is possible only by possessing an adequate American merchant marine, the percentage of our exports of manufactured goods would greatly and naturally increase. It does not require a great stretch of imagination to picture the prosperity which would spread its mantle of contentment and happiness over the whole length and breadth of the United States if this 5 percent were even increased to 20 percent, to say nothing of what England and Germany are doing in normal times with their 45 and 55 percent.

In the exportation of American foodstuffs, competition does not figure, for foreign nations are simply buying from us the things that they themselves cannot grow in sufficient quantities for their needs, but this is not true of manufactured goods. In the marketing of these we find ourselves in direct competition with other manufacturing nations of the world's keen and sometimes unscrupulous competition. In the absence of American ships to carry our goods this is competition which we cannot hope to meet.

What Constitutes a Merchant Marine?

Let us consider what really constitutes a country's merchant marine. It is unfortunate, but a very true fact, that most of our people, whose ideas represent public opinion, visualize great Atlantic liners when they think of the merchant marine. These huge liners are most in evidence to the traveling public who happen to visit our large eastern seaports, and their size and magnificence appeal to the eye and mind in a most emotional way.

In Great Britain, for instance, it is not due alone to this class that she stands unrivaled in the world's cargo carrying. It is to the tremendous number of first class tramps, with their enormous cargo capacity that she owes her preponderance over every other nation. It is merely wasting time to attempt to solve the problem by acquiring a few steamers to run on regular routes and with fixed schedules. Ships of the tramp type are the prime necessity in international trade. If a poor harvest in South America cuts off grain export, then the tramp that has worked in the South Atlantic Ocean seeks freight at the mouth of the Danube or in South Russia, or in the Indian Ocean, or the East Indies. Wherever freight is offered there she may go—to Rangoon for rice, to Calcutta for jute, or to Java for sugar. It would be absurd to engage in international trade with such ships and confine their operations to the carriage of our own exports and imports alone, for, as those conversant with shipping in America to-day can easily see that they would be roaming over the seas in ballast for six months out of twelve, while their competitors, roaming over the world usually with full cargoes and consequently greater earning power, would be able to underbid American ships in rate quotations on American cargoes whenever such cargoes were offered.

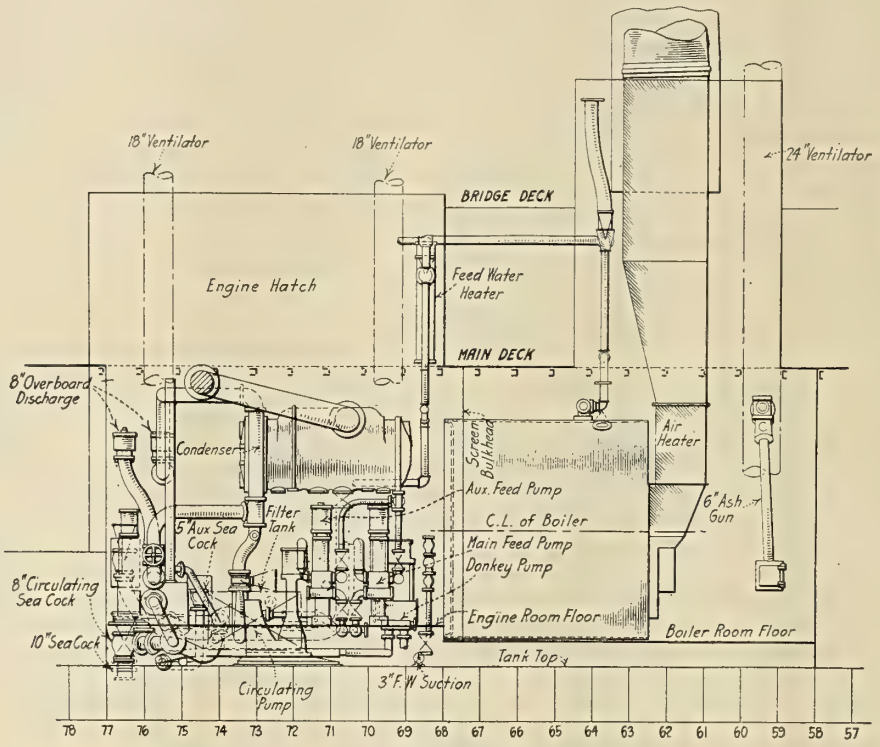
If conditions brought about a war between America and one of those nations who now carry most of our products to foreign markets, the first thing that those nations would do would be to withdraw all their merchant ships from this side of the Atlantic, leaving America with no means of transporting her overflow of products overseas. The small merchant marine we now have would be taken over by the government for war purposes, supplying the fleet, transporting troops and so on, thus bringing the commerce of the country to a standstill as far as foreign countries are concerned. This, most Americans must admit, is a deplorable state of affairs to have to look forward to in case of trouble at any time with the nations that we are now beholden to, to get our products on the markets of the world.

Germany's Example

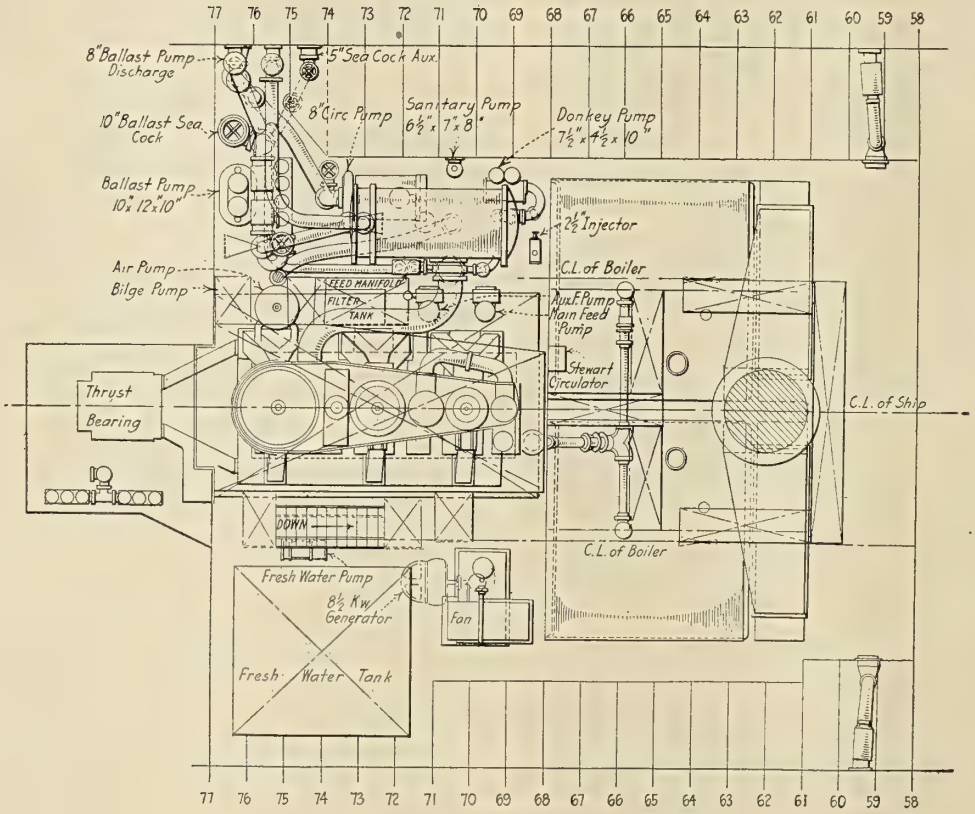
Talk will never build a merchant marine. The more we talk the further away we are from ever having anything approaching a merchant marine. What is required is action—and the quicker we have that action the better it will be for the United States. Thirty years ago Germany saw far enough ahead to know that if she was ever to hope to hold a leading place in the maritime world she had to have ships to do it with. What did she do? The matter was put before the people, especially those who lived in inland states, as a matter of national importance. The German people were quick to see that their future commercial life depended on its merchant marine and promptly told the government that they wanted a merchant marine, with the result that to-day they have one of the finest merchant marines in the world. America can do the same thing that Germany did. She has to-day a better opportunity, a better chance than Germany ever had. She has had the opportunity of benefiting by the important lessons that this war has brought about regarding merchant marines, and surely this great country of ours is going to take this chance that has been offered to her and profit by it.

It is impossible to restore the flag to the wide seas unless remedial and adequate legislation is effected. No enduring legislation is possible unless it is based on an active imperative public sentiment demanding that the American flag be put once more on the seven seas to stay there as long as ships sail the seas.

MACHINERY ARRANGEMENT, S. S. YUNA



Longitudinal Section Through Machinery Space


77 76 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58
8" Ballast Pump Discharge
5" Sea Cock Aux.
8" Circ Pump
Sanitary Pump 6½" x 7" x 8"
Donkey Pump 7½" x 4½" x 10"
10" Ballast Sea Cock
Ballast Pump 10" x 12" x 10"
2½" Injector
Air Pump
C.L. of Boiler
Bilge Pump
FEED MANIFOLD
FILTER TANK
Aux. F. Pump
Main Feed Pump
Stewart Circulator
Thrust Bearing
C.L. of Ship
DOWN
C.L. of Boiler
Fresh Water Pump
8½ Kw. Generator
Fan
Fresh Water Tank
77 76 75 74 73 72 71 70 69 68 67 66 65 64 63 62 61 60 59 58

Plan of Machinery Space

Launch of S. S. *Yuna*

Clyde Line Steamers Built on the Lakes

Description of Welland Canal Size Ocean-Going Freighters Built by the Great Lakes Engineering Works, Detroit, Mich.

THE three steamers, *Yaque, Yuna* and *Inca,* built at Detroit, Mich., in 1915, by the Great Lakes Engineering Works for the Clyde Steamship Company, New York, were designed for a special trade among the West Indies, which limited the draft to 15 feet. On this draft they have a capacity of about 2,000 tons deadweight and a sea speed of about 10 knots.

The vessels were built under special survey to Lloyd's highest class for both hull and equipment. The principal dimensions are as follows:

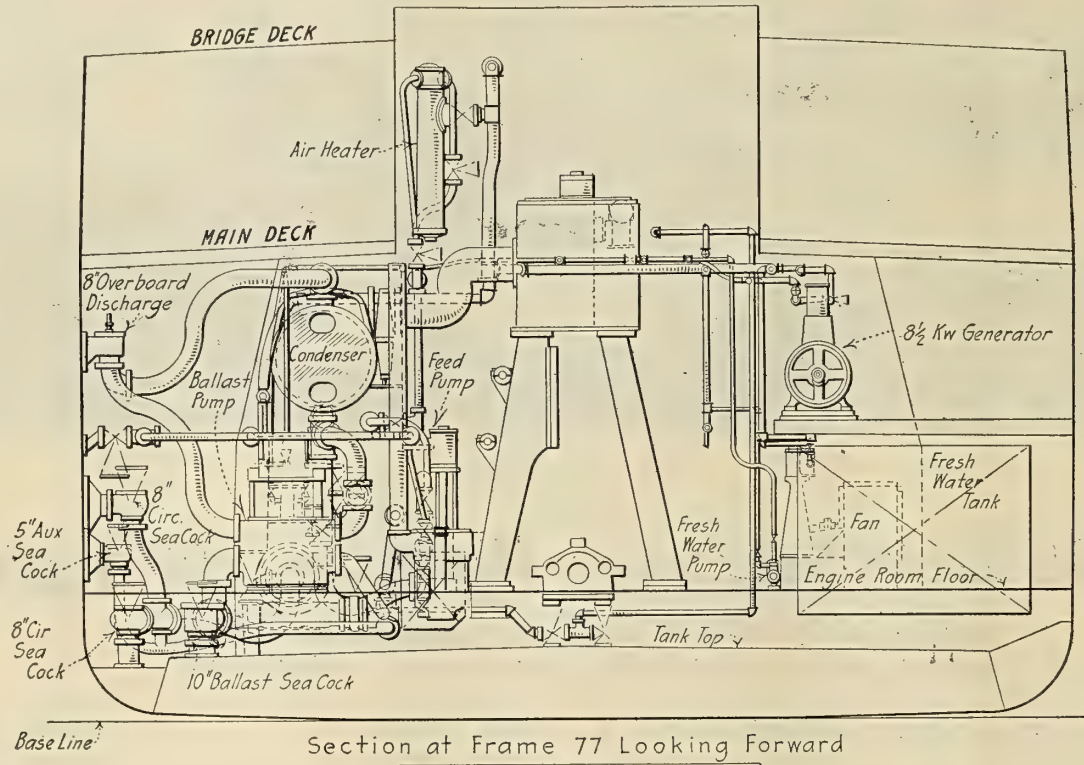
Length over all	258 feet 6 inches
Length between perpendiculars	246 feet 0 inches
Beam molded	38 feet 3 inches
Depth molded	18 feet 0 inches

All three vessels are sister ships of the single deck type with forecastle and bridge decks of steel. Quarters for the officers and crew are in the bridge and in an after deck house, respectively. The hatches are as large as possible for the size of the vessel, two of them being 18 feet by 15 feet, one 20 feet by 15 feet, and one 22 feet by 15 feet. The deck is supported by girders and a single row of wide spaced pillar stanchions, leaving the holds practically unobstructed.

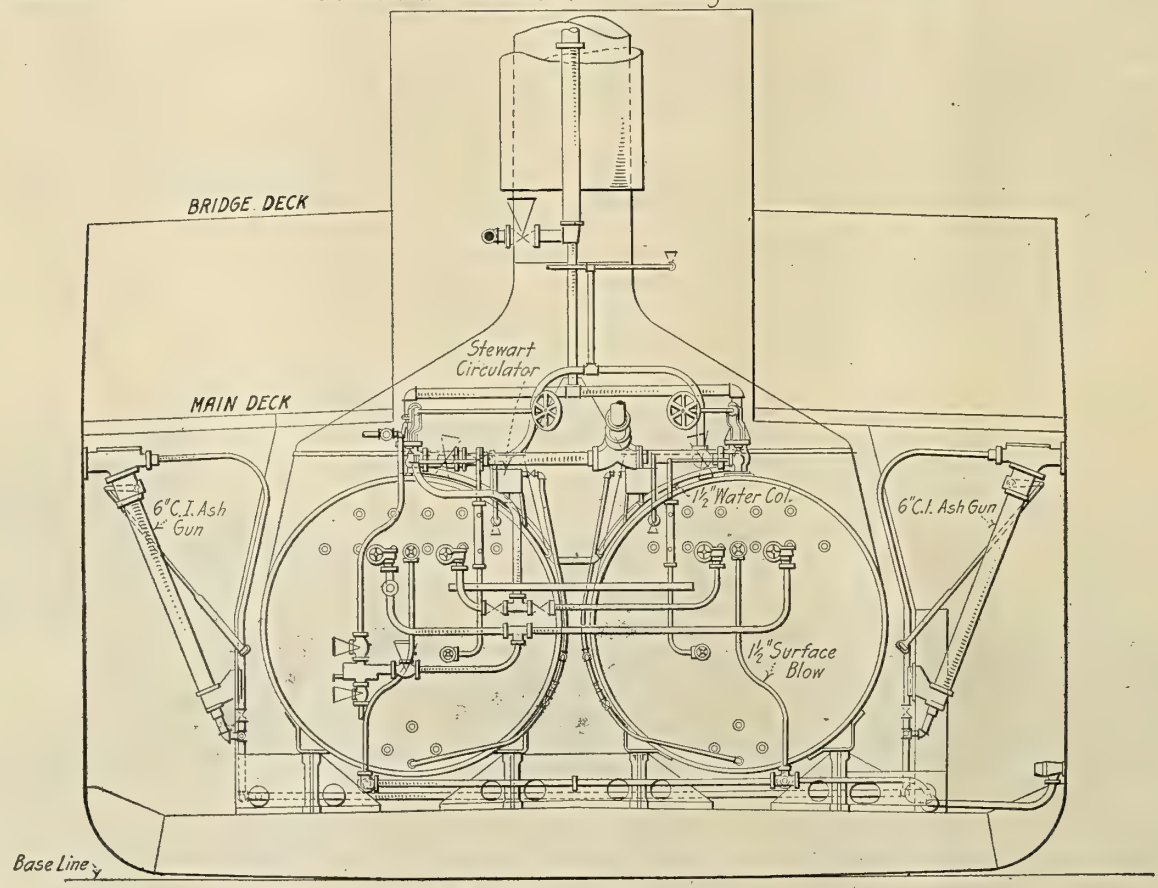
Coal is carried in permanent wing bunkers, which run

S. S. *Yuna* on the Ways at the Great Lakes Engineering Works

SECTIONS THROUGH MACHINERY SPACE

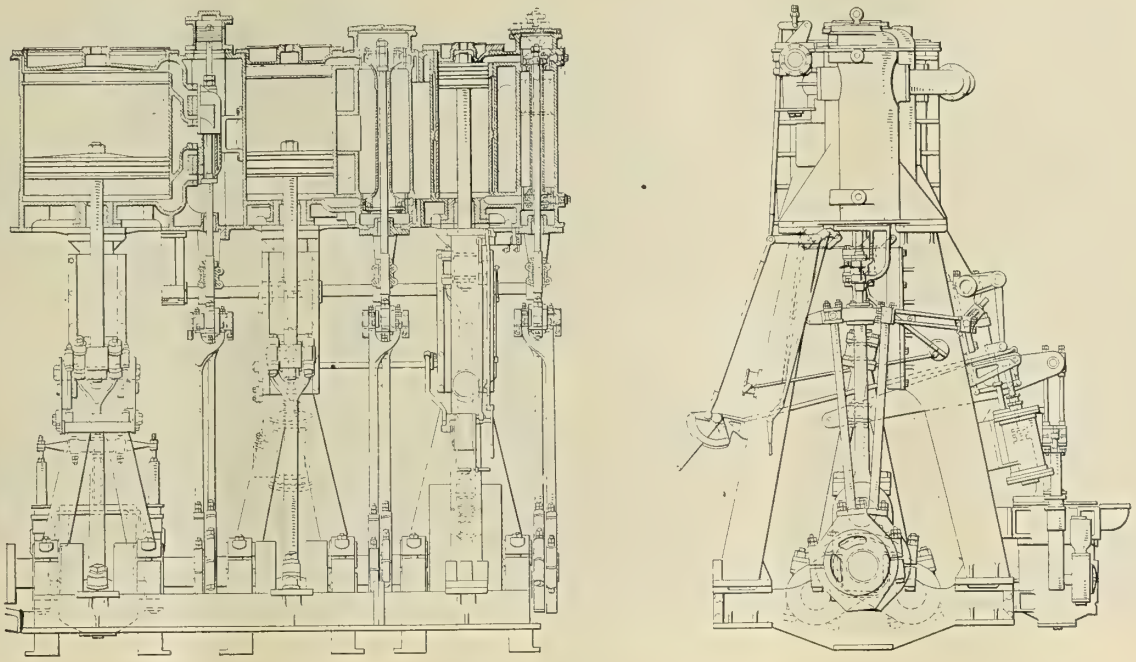


Section at Frame 77 Looking Forward

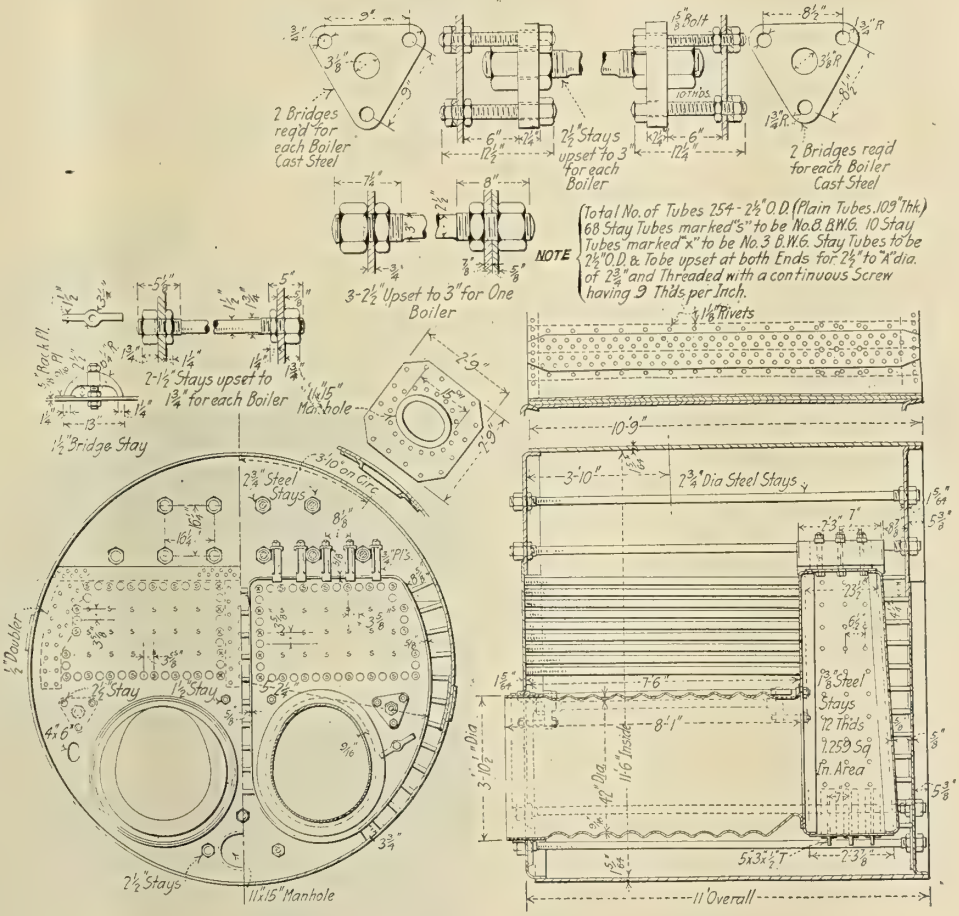


Section at Frame 68 Looking Forward

PROPELLING MACHINERY, S. S. YUNA

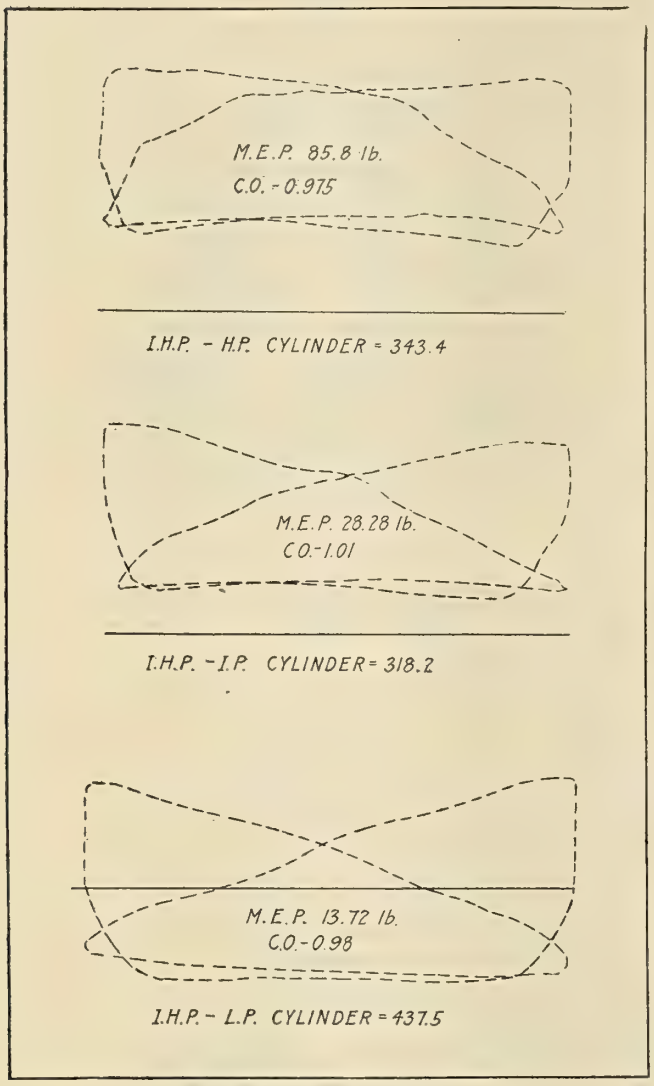


Main Engine


2 Bridges req'd for each Boiler Cast Steel
2½" Stays upset to 3" for each Boiler
2 Bridges req'd for each Boiler Cast Steel
3-2½" Upset to 3" for One Boiler
NOTE
Total No. of Tubes 254 - 2½" O.D. (Plain Tubes .109" Thk.) 68 Stay Tubes marked "S" to be No. 8 B.W.G. 10 Stay Tubes marked "X" to be No. 3 B.W.G. Stay Tubes to be 2½" O.D. & to be upset at both Ends for 2¼" to "A" dia. of 2⅜" and Threaded with a continuous Screw having 9 Thds per Inch.
2-1½" Stays upset to 1¾" for each Boiler
1½" Bridge Stay
11"x15" Manhole
1⅛" Rivets
2¾" Dia Steel Stays
7/8" Steel Stays 72 Thds 1.259 Sq In. Area
5x3x½" T
11'-0" Overall
2½" Stays
11"x15" Manhole
½" Doubler
Stay
Boiler

the full length of the machinery space on each side, and in an auxiliary cross bunker just forward of the boiler room. There are also auxiliary bunkers in the bridge. The total bunker capacity is 325 tons, the total water ballast capacity 539 tons and the boiler feed tank capacity 78 tons.

The officers' mess rooms and sleeping rooms are finished on the sides and overhead in oak, but all wood has been omitted from the passageways and the crew's quarters. All floors in the passageways and in the officers' and crew's quarters are of Litosilo. Elsewhere the steel decks are uncovered. The cargo holds have wood

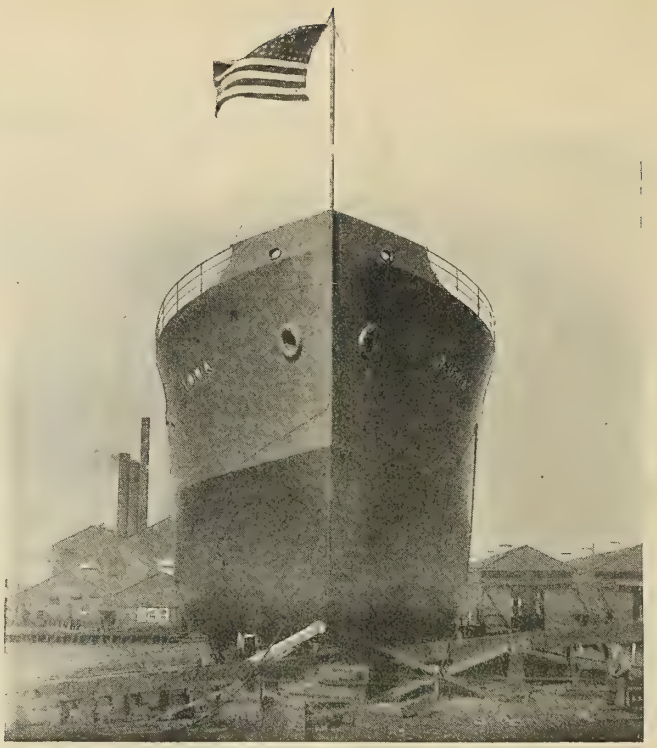


Indicator Cards from S. S. *Inca*

Engine, 17 — 28½ — 48 × 36 inches; boiler pressure, 172 pounds per square inch; vacuum, 24½ inches; piston speed, 582 feet per minute; mean effective pressure referred to low pressure cylinder, 34.4 pounds per square inch; revolutions per minute (average), 96.9; total indicated horsepower, 1,099; slip, 6.46 percent; draft forward, 8 feet 6 inches; draft aft, 12 feet 6 inches; speed, 12.63 miles per hour.

ceilings on the tank top and cargo battens on the sides. Aside from these items there is practically no wood used in the ships.

The cargo handling gear consists of two derrick masts each carrying four six-ton booms, 38 feet long. In addition to this equipment there is a steel boom on the foremast, having a lifting capacity of 30 tons. There are four double drum winches, three of these being 8 inches by 8 inches single geared, and one 8¼ inches by 10 inches double geared, of especially heavy construction, for the 30-ton boom. The standing rigging is of plow steel wire

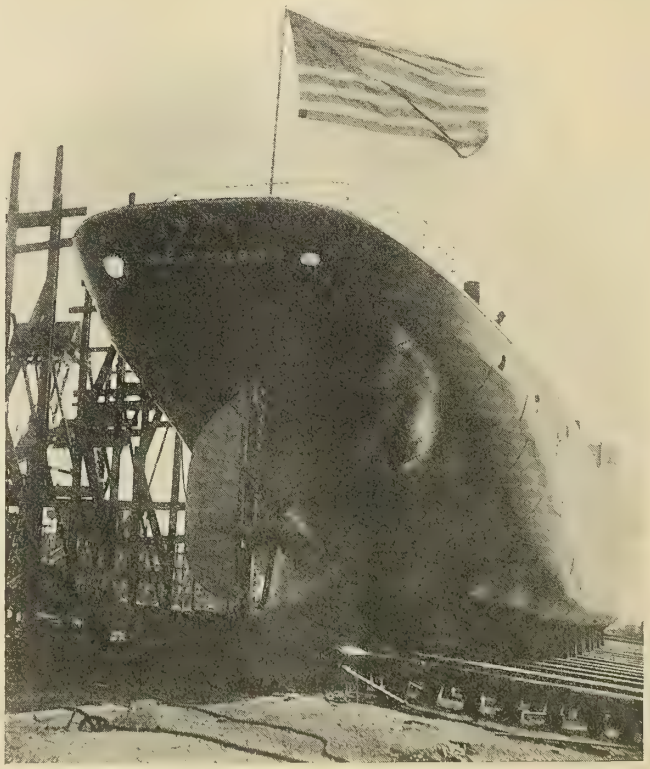


Bow View, S. S. *Yuna*

rope. The running rigging for the 6-ton booms is of durable wire rope, and for the 30-ton boom of plow steel wire. The after winch has an extended shaft with warping heads for handling lines.

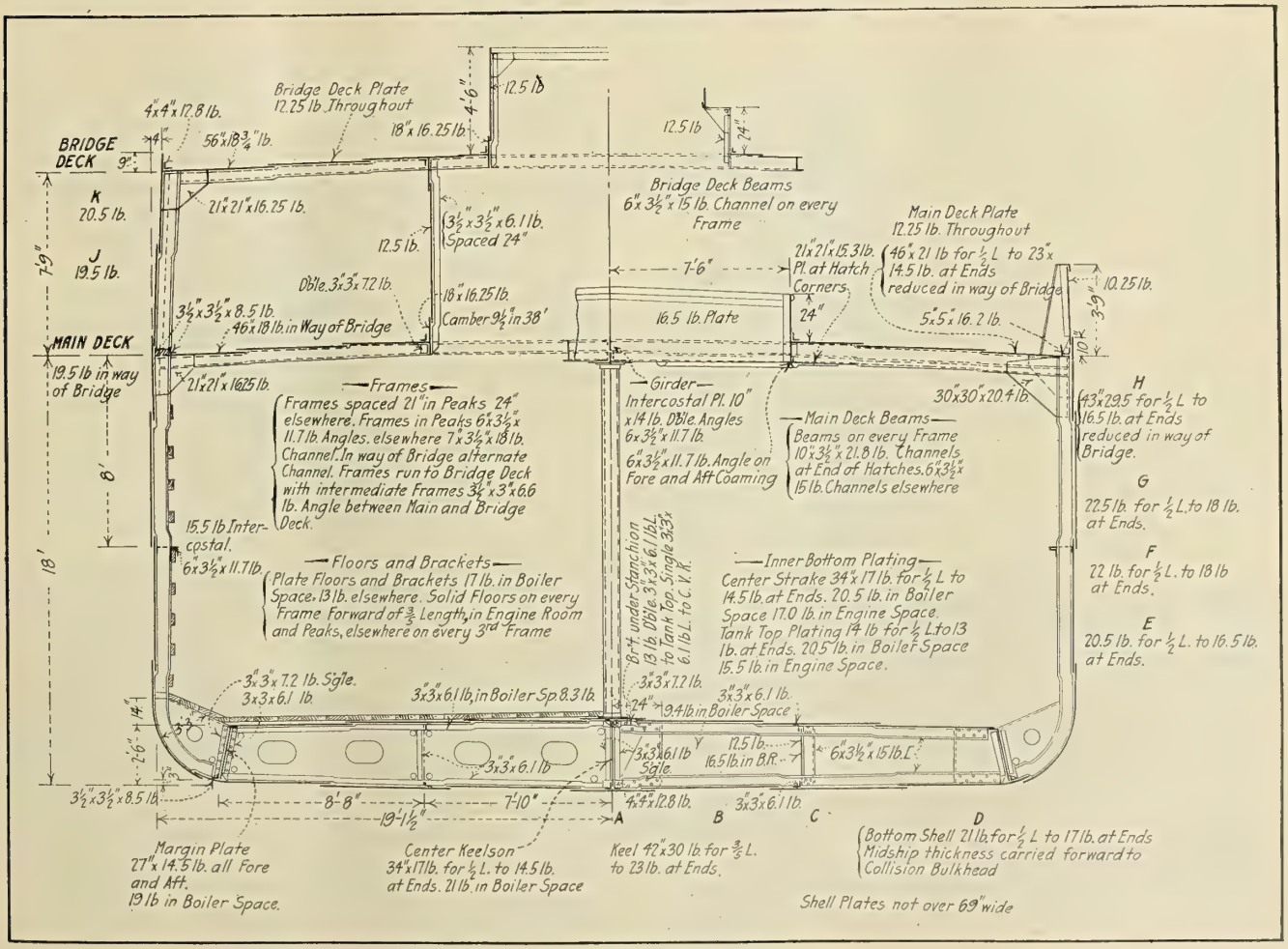
There is also a steel windlass on the forecastle deck and the steering engine is located in the after deck house, directly connected to a geared quadrant and controlled by telemotor from the pilot house.

Steam for all working purposes is furnished at 190



Stern View, S. S. *Yuna*

S. S. *Yuna* on Trial Trip


BRIDGE DECK
MAIN DECK
K 20.5 lb.
J 19.5 lb.
19.5 lb in way of Bridge
Bridge Deck Plate 12.25 lb Throughout
4"x4"x12.8 lb.
56"x18¾" lb.
18"x16.25 lb
12.5 lb
Bridge Deck Beams 6"x3½"x15 lb. Channel on every Frame
21"x21"x16.25 lb.
3½"x3½"x6.1 lb. Spaced 24"
Dble. 3"x3"x7.2 lb.
3½"x3½"x8.5 lb. 46"x18 lb. in Way of Bridge
18"x16.25 lb. Camber 9½" in 38'
Main Deck Plate 12.25 lb. Throughout
21"x21"x15.3 lb. Pl. at Hatch Corners
46"x21 lb for ½ L to 23"x14.5 lb. at Ends reduced in way of Bridge
10.25 lb.
5"x5"x16.2 lb.
16.5 lb. Plate
24"
7'-6"
Frames
Frames spaced 21" in Peaks 24" elsewhere. Frames in Peaks 6"x3½"x11.7 lb. Angles, elsewhere 7"x3½"x18 lb. Channel. In way of Bridge alternate Channel. Frames run to Bridge Deck with intermediate Frames 3¼"x3"x6.6 lb. Angle between Main and Bridge Deck.
Girder
Intercostal Pl. 10" x14 lb. Dble. Angles 6"x3½"x11.7 lb.
6"x3½"x11.7 lb. Angle on Fore and Aft Coaming
Main Deck Beams
Beams on every Frame 10"x3½"x21.8 lb. Channels at End of Hatches. 6"x3½"x15 lb. Channels elsewhere
30"x30"x20.4 lb.
15.5 lb Intercostal.
6"x3½"x11.7 lb
Floors and Brackets
Plate Floors and Brackets 17 lb. in Boiler Space, 13 lb. elsewhere. Solid Floors on every Frame Forward of ⅔ Length, in Engine Room and Peaks, elsewhere on every 3rd Frame
8'-4" under Stanchion 13 lb. Dble. 3"x3"x6.1 lb. to Tank Top. Single 3"x3"x6.1 lb. to C. V. K.
Inner Bottom Plating
Center Strake 34"x17 lb. for ½ L to 14.5 lb. at Ends. 20.5 lb. in Boiler Space 17.0 lb. in Engine Space.
Tank Top Plating 14 lb for ½ L. to 13 lb. at Ends. 20.5 lb. in Boiler Space 15.5 lb. in Engine Space.
3"x3"x7.2 lb. Sgle.
3"x3"x6.1 lb.
3"x3"x6.1 lb. in Boiler Sp 8.3 lb.
3"x3"x7.2 lb.
24"
9.4 lb. in Boiler Space
3"x3"x6.1 lb.
3"x3"x6.1 lb Sgle.
12.5 lb.
16.5 lb. in B.R.
6"x3½"x15 lb. L.
3"x3"x6.1 lb
4"x4"x12.8 lb.
3"x3"x6.1 lb.
3½"x3½"x8.5 lb.
8'-8"
7'-10"
19'-1½"
A
B
C
D
H (43"x29.5 for ½ L to 16.5 lb. at Ends reduced in way of Bridge.
G 22.5 lb. for ½ L. to 18 lb. at Ends.
F 22 lb. for ½ L. to 18 lb at Ends.
E 20.5 lb. for ½ L. to 16.5 lb. at Ends.
Margin Plate 27"x14.5 lb. all Fore and Aft. 19 lb in Boiler Space.
Center Keelson 34"x17 lb. for ½ L. to 14.5 lb. at Ends. 21 lb. in Boiler Space
Keel 42"x30 lb. for ⅔ L. to 23 lb. at Ends.
Bottom Shell 21 lb. for ½ L to 17 lb. at Ends
Midship thickness carried forward to Collision Bulkhead
Shell Plates not over 69" wide
7'9"
8'
18'
14"
2'6"
3'9"
10"

Midship Section

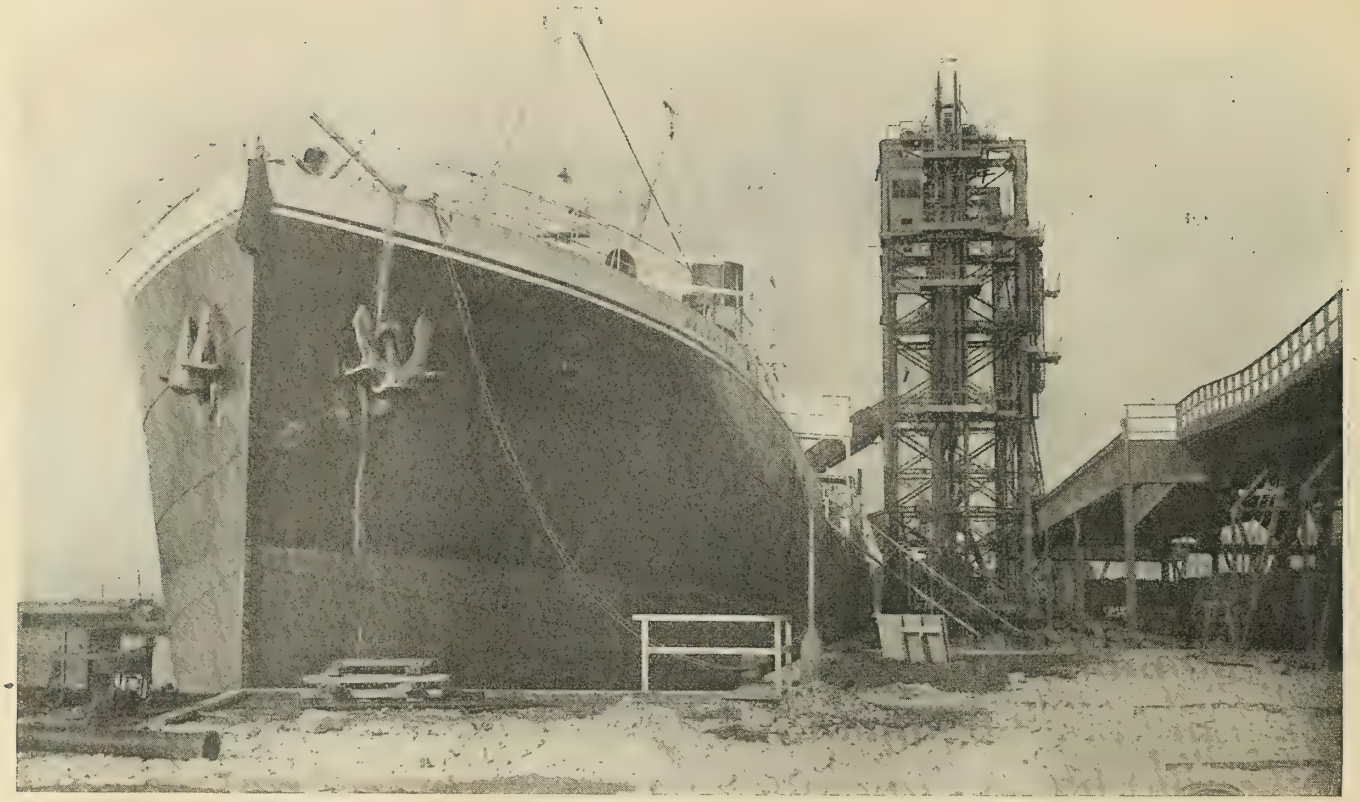


Fig. 1.—Ocean Liner Coaling at King George Dock at Hull

pounds per square inch working pressure by two Scotch boilers, 11 feet 6 inches inside diameter and 11 feet long overall. The shell plates are 1 5/64 inches thick, and each boiler has two 42-inch Morison furnaces and from material 9/16 inch thick. Each furnace has a separate combustion chamber and there are 254 2½-inch tubes in each boiler.

The total heating surface of each boiler is 1,476 square feet, divided as follows: Tubes, 1,246 square feet; furnaces, 85 square feet; combustion chambers, 145 square feet. The grate surface of each boiler (with grate bars 5 feet 3 inches long) is 36¾ square feet, making a ratio of heating surface to grate area of 40 to 1. Through the tubes, the draft area is 8.17 square feet, which makes the ratio of draft area to grate area 1 to 4.5.

Steam is conveyed to the main engines through pipes 6 inches in diameter, fited with 4½-inch stop valves. The auxiliary stop valves are 3 inches diameter.

Main Engines

The ships are all single screw vessels, driven by a solid four-bladed propeller 11 feet 10 inches diameter, having a cast pitch 12 feet 3 inches at the tip. The developed area of the propeller is 55 square feet.

The main engines are of the vertical, inverted, triple expansion type with cylinders 17 inches, 28½ inches and 48 inches diameter with a common stroke of 36 inches. At a speed of 95 revolutions per minute it is estimated that the engines will develop 1,000 horsepower.

In the arrangement of the cylinders the high pressure cylinder is placed forward; following this is the intermediate pressure cylinder and aft is the low pressure cylinder; the crank sequence being high pressure, low pressure and intermediate pressure. Both the high pressure and intermediate pressure cylinders are fitted with piston valves and the low pressure cylinder has a double ported slide valve to the spindle of which a balance piston is attached. The high pressure piston has deep removable solid followers, with spring ring, and the intermediate and low pressure pistons have special metal packing rings.

All the piston rods are 4½ inches diameter. The crossheads are fitted with white metal for ahead and backing faces. The crosshead pins are 4½ inches diameter by 4½ inches long. The connecting rods are of forged construction 6 feet 9 inches long center to center, made from open-hearth steel forgings. The diameter at the top is 4 inches and at the bottom 5 inches. Brass crosshead pin boxes are fitted with bolt adjustment. The crank pin boxes are of cast steel, lined with white metal, and have bolt adjustment. All piston rods and valve stems are fitted with metallic packing.

The crank shaft is of the built-up type, having wrought steel slabs which are shrunk on and doweled. The crank shaft is 9¾ inches diameter and the crank pins 9¾ inches diameter by 10 inches long. The crank shaft is supported by six main bearings 9 inches long.

The thrust shaft is also 9¾ inches diameter. It is fitted with four driving collars bearing against horseshoe shaped white metal faced rings. The outboard shaft is 10¾ inches diameter in the body and 10⅞ inches diameter in the stern bearing, which is 4 feet 2 inches long. The line shafting is 9¼ inches diameter in the body, enlarged to 9½ inches in the bearings, of which there are four.

The auxiliary machinery includes a vertical duplex ballast pump 10 inches by 12 inches by 10 inches; an 8-inch centrifugal main circulating pump, driven by a

6-inch by 6-inch engine; two vertical simplex feed pumps 10 inches by 6 inches by 12 inches; a donkey vertical duplex pump, 7½ inches by 4½ by 10 inches; a vertical, simplex sanitary pump 6½ inches by 7 inches by 8 inches. The bilge pumps are attached to the main engine and are 3½ inches diameter by 18 inches stroke. The air pump, which is also attached to the main engine, and is driven from the high pressure crosshead, is an Edwards pump, 17 inches diameter by 18 inches stroke. There is also fitted to the main engine a direct connecting reverse cylinder 10 inches diameter by 15 inches stroke and a 6-inch by 6-inch single cylinder turning engine. The main condenser has a cooling surface of 1,500 square feet.

Positive draft is furnished by a single blower having a 30-inch wheel, 33-inch suction and a 28-inch by 30-inch discharge. The blower is driven by a 5-inch by 5-inch engine. A feed water heater, 11½ inches diameter by 5 feet 7 inches long, is provided, and the ship is lighted throughout with electricty, current being obtained from an 8½ kilowatt generator driven by a 6-inch by 6-inch engine.

Coal Handling on the British Waterfront

Distinctive Features of Coal Handling Appliances at British Docks—British and American Methods Compared

THE coal handling methods pursued in Great Britain in transferring coal from rail to ship are in part similar to those in use in America and in part dissimilar. There is probably nothing to correspond to the recently built steel piers at Hampton Roads, where the coal is first dumped into special pier cars and then run out on the pier deck, a car elevator having been used in the course of the trip to secure the change of level. However, they do have gravity piers on whose decks the cars are shifted along slight grades by gravity and then returned by gravity down slopes to the "empty" yard.

The steel frame hoisting and dumping tower is used on both sides of the Atlantic. There are differences more or less pronounced between British and American designs. Thus, in America it is customary to divide into two distinct parts the total lift required before dumping. In Great Britain the entire lift is ordinarily accomplished as a single operation. With regard to this difference in practice, there can scarcely be any doubt but that the American system is better. The hoist will have a greater capacity because of the shorter vertical trip. The typical British hoist receives its loaded car of coal at the gen-

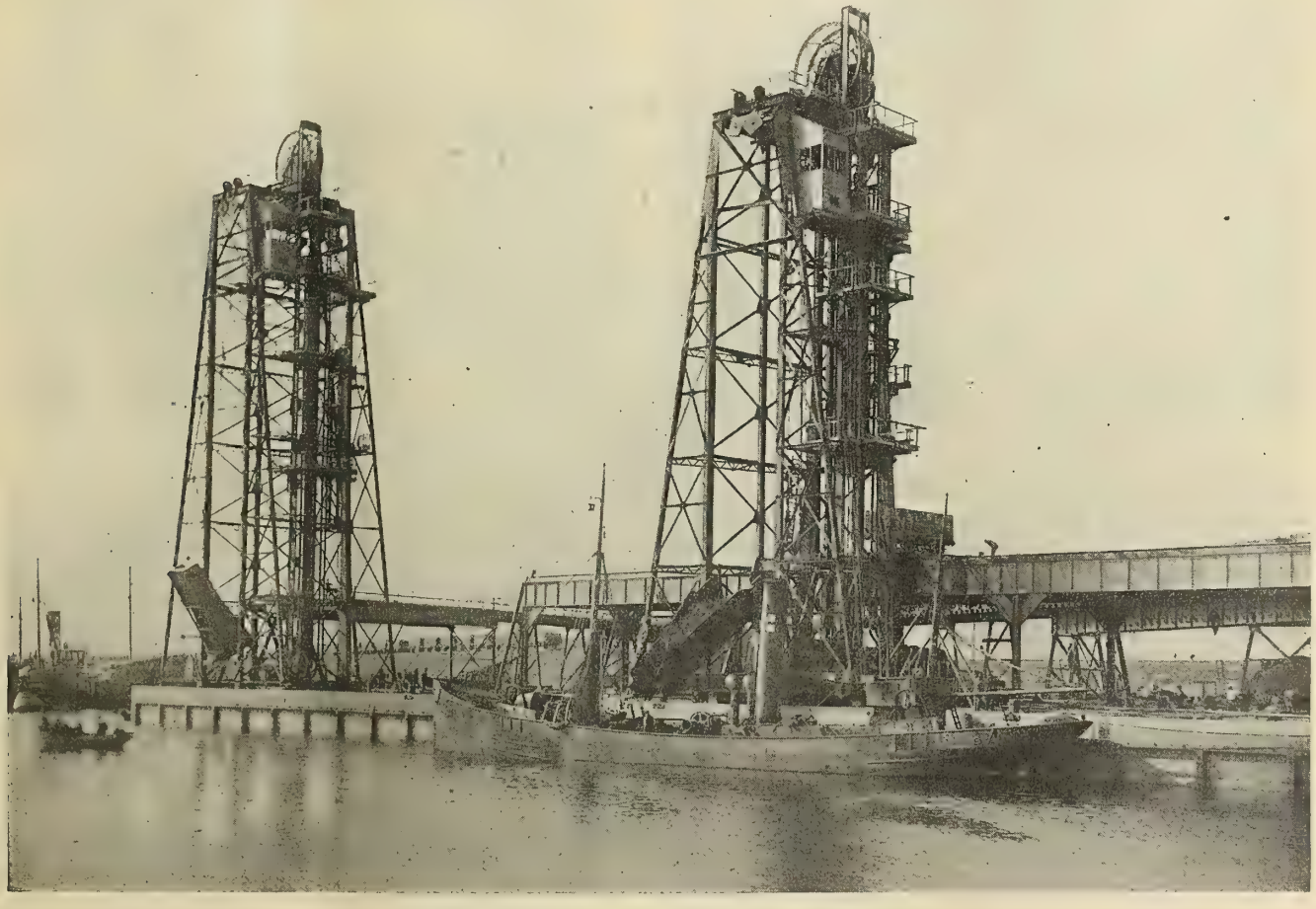


Fig. 2.—Fixed Hoist and Movable Hoist at King George Dock, Hull

eral level, from which point it carries the car to the dumping level and then discharges it.

In America the dumping is differently done. Practically every up-to-date car dumper in the country overturns the car sideways. In Great Britain, on the contrary, the prevailing practice seems to be to dump endwise. In fact, the British method is to *tip* the car, say to an angle of 45 degrees. It is necessary accordingly to provide specially for letting the coal out at the end. The American method is to *overturn* the car—not to tip it. The latest practice with big car dumpers provides for turning the car through 160 degrees. With the British practice the bottom of the car is still the bottom at the time of discharge, while with American practice the *side* of the car becomes the bottom at that moment. This difference in general method makes quite a big difference in the design of the hoist. The British hoists are simpler.

The British coal car has ordinarily a capacity ranging from 10 to 20 long tons. There are some cars, however, of American size. In the United States the typical coal car holds about 40 or 45 tons. The Norfolk & Western Railroad is introducing cars having double this capacity. Naturally, the great difference in weights to be handled makes a difference in the hoists themselves.

The British car coming down empty in the hoist must of course be taken out of the way in order to have things free for the next loaded car. This is accomplished by running the empty car by gravity from some level above the ground over a track sloping down. This track may be carried by a special trestlework or viaduct. This feature is both like and unlike American arrangements. The American car dumper has a gravity run-off, but it is located at the lowest level of the cradle movement. This level is above the general surface, because the hoists themselves are set upon elevations.

The cradle used in Great Britain for controlling the car during the hoisting and discharging period is often very different from the cradle on an American car dumper. The British device may at times be a very simple arrangement, consisting largely of a short length of track arranged on a skeleton platform. Chains, hung to a cross piece or yoke, are secured to this platform and the whole is lifted. The chains are so arranged that the car is tilted upon being lifted up. With this simple device a revolving crane, usable for other purposes as well, may be employed to hoist and swing the loaded car. When the car is in correct position over the hatch of the vessel being loaded the coal is discharged.

The crane may have a runway. In this way provision is made for shifting the vessel-loading arrangements along the face of the dock. The British hoists are sometimes fixed in position and sometimes they are movable.

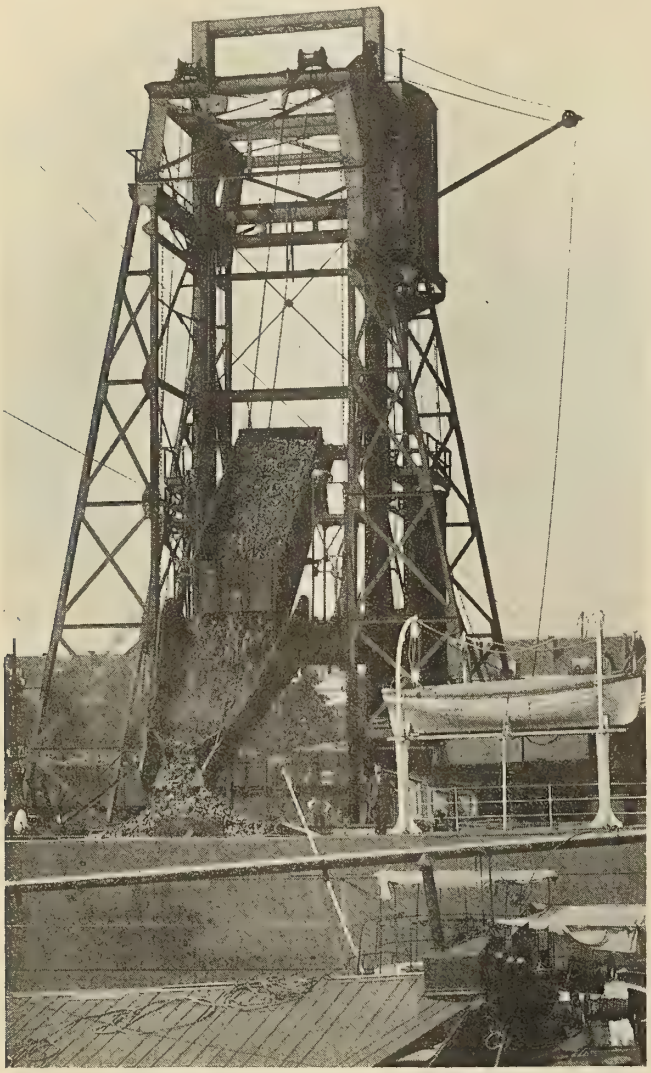
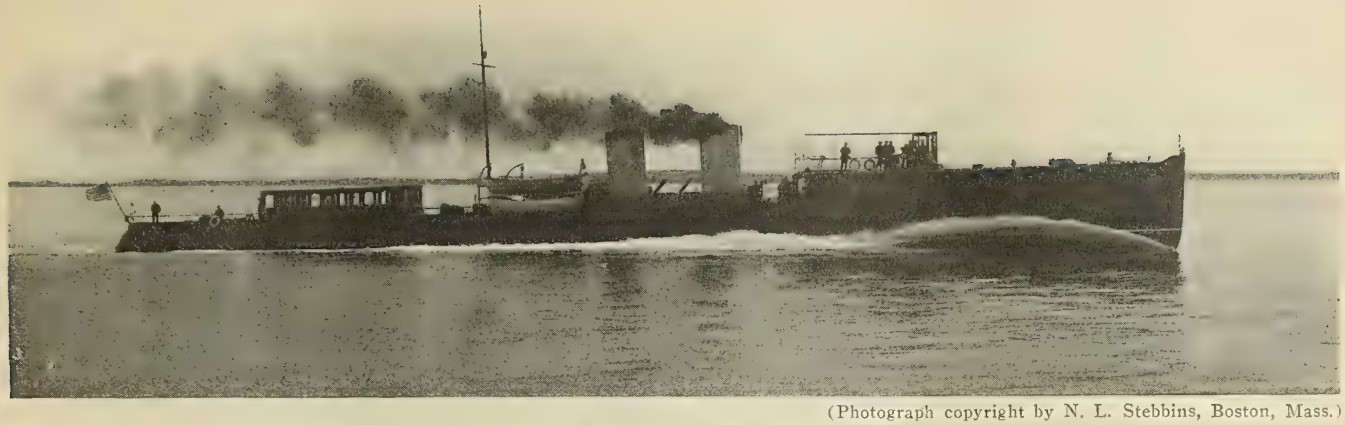


Fig. 3.—British Hoist at Rotterdam

Fig. 4.—30-Ton Movable Hydraulic Crane at North Eastern Railway, Middlesbrough Docks



(Photograph copyright by N. L. Stebbins, Boston, Mass.)

Steam Yacht *Winchester* Bettering Her Contract Speed of 30 Knots

New Steam Yacht Winchester

Turbine-Driven Yacht of Destroyer Type Exceeds Contract Requirements on Trials

ONE of the most notable additions in recent months to the fleet of the New York Yacht Club is the steam yacht *Winchester,* built for Mr. Peter W. Rouss, of New York, by the Bath Iron Works, Bath, Me., from the designs and under the supervision of Messrs. Cox & Stevens, naval architects, New York. The new *Winchester* is the result of the experience of her owner and his naval architects with several very high speed vessels, the last of these, also named the *Winchester,* which was 205 feet long with a speed of 34 knots, now being in the service of the Canadian government.

The hull of the new *Winchester,* 225 feet long by 21 feet beam, is in appearance and form not unlike a modern United States destroyer, with straight sheer, flush deck and cruiser type of stern, the topsides being raised forward for a very considerable distance from the stem with a pronounced flare to the sections above the waterline. The underbody is carefully designed with a view not only to ease in driving at high speeds, but also to meet the owner's requirements for an able sea boat.

Propulsion is by twin screws, driven by Parsons turbines designed to deliver a total of 7,500 horsepower. In each turbine is incorporated an astern turbine, and their design is such that good economy can be obtained at both the cruising and full speeds. Steam is supplied by two Normand oil-fired watertube boilers, located in one stokehold.

The machinery is placed with its center of gravity ap-

(Photograph copyright by N. L. Stebbins, Boston, Mass.)

Wake of the *Winchester* at Full Speed

proximately amidships, the engine room being aft of the boiler room and the fuel tanks partly aft and partly forward at each end of the machinery space. This disposition of the machinery gives the best possible arrangement of weights and the subdivision of the fuel makes it possible to regulate the trim of the yacht at will under all conditions of loading.

The yacht was designed for a speed of 30 knots, but her official trials carried out over the government's course at Rockland, Me., developed a speed of 31.6 knots.

The general arrangement of the yacht is of special interest, as it shows the results of careful study of the conditions imposed by the owner for comfortable living and efficient operating quarters. As shown by the photographs, there is a forward and after deckhouse on the main deck, the top of the forward deckhouse being at the same level as the forecastle deck. The dining room, which is at the after end of the raised forecastle, is 20 feet by 15 feet, and forward of this is the pantry, below which on the berth deck is the galley. In the raised forecastle forward of the pantry are the officers' quarters and below on the berth deck are the crew's quarters.

The after deckhouse, which is 29 feet by 15 feet, contains the main living room, from which a stairway leads to the owner's and guests' quarters on the berth deck aft. The decorations and furnishings of the living quarters are in harmony with the design of the yacht and every convenience is provided. The deckhouses, skylights, rails, companionways and other outside deck work are of teak instead of mahogany.

The yacht is equipped in the most complete manner throughout, having steam heat, electric lights, steam capstans and steam steering gear. The equipment of boats includes a 26-foot high speed owner's launch, a 25-foot crew's launch, both equipped and passed as lifeboats, and a 16-foot dinghy.

Test of Ward Watertube Boiler*

Naval Board Makes Exhaustive Tests of Ward Type of Watertube Boiler—Data and Conclusions

BY LIEUTENANT S. M. ROBINSON, U. S. N.

A Ward boiler was tested at the plant of the Charles Ward Engineering Works, Charleston, W. Va., recently by a board consisting of Lieutenant Commander H. C. Dinger, U. S. N., Lieutenant S. M. Robinson, U. S. N., Lieutenant A. M. Penn, U. S. N., and Mr. A. Conti.

Particulars of the boiler tested are as follows:

Type of boiler.....Ward Straight Tube
Total tube heating surface.....4,405 square feet
Volume of furnace.....476 cubic feet
Fuel used.....Elk Refining Co., paraffine base
Number of burners.....7
Type of burners....Bureau of Steam Engineering, Type I

The boiler was fitted with wooden air box at front, fitted with air lock. Air was supplied by means of a motor-driven Sturtevant blower. As the blower motor was of the constant-speed type, the air supply was regulated by means of a butterfly shutter in blower discharge and a sliding door on front of air box.

Feed was supplied by means of two horizontal Blake plunger pumps discharging through two Reilly feed-water heaters.

Oil was supplied by means of two Blake horizontal, piston, simplex oil pumps, discharging through Reilly oil-fuel heater (coil type) to the fuel-oil main at boiler front; a special air chamber was fitted on the discharge line. There were fitted in addition three large air chambers

* Abstract of article from Journal of American Society of Naval Engineers.

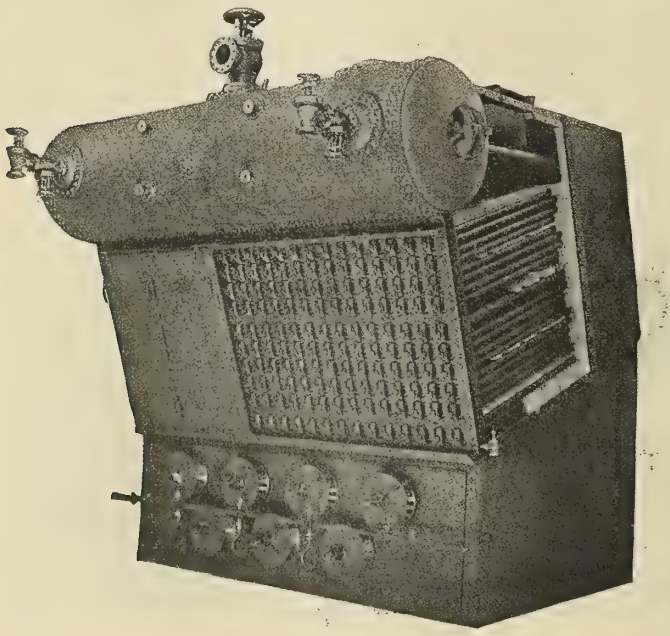


Fig. 1.—Ward Test Boiler

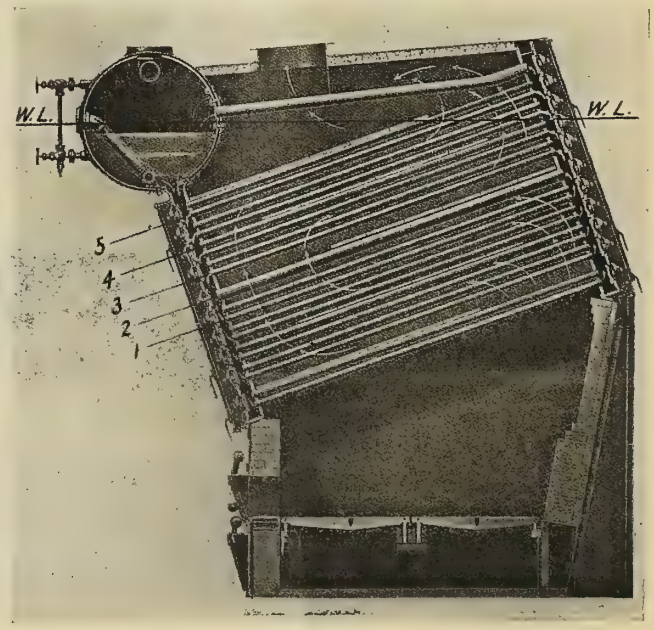


Fig. 2

DRUM AND HEADERS OF WARD BOILER

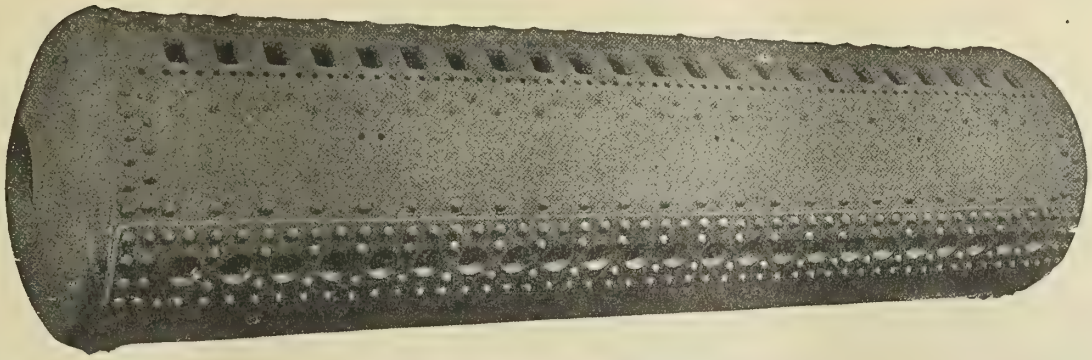


Fig. 3.—Steam Drum

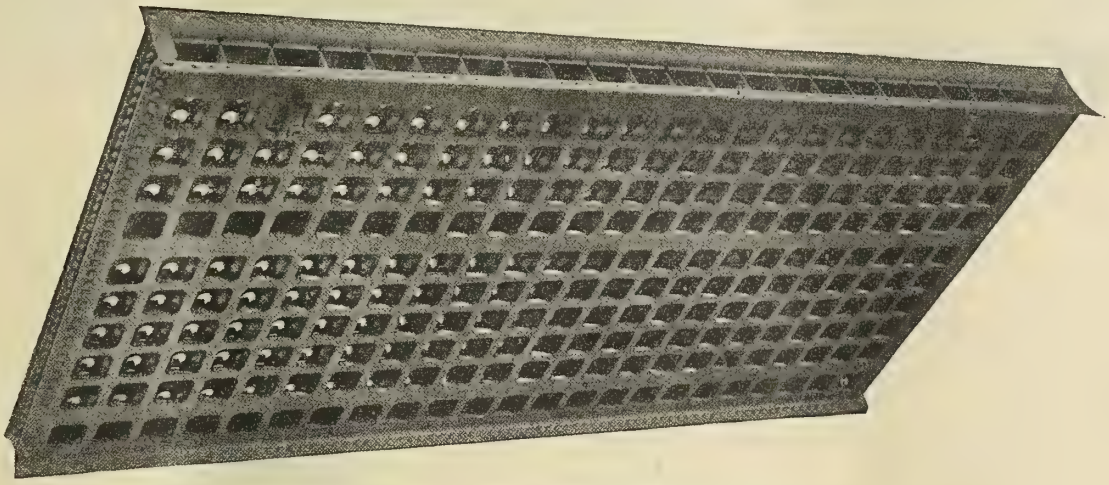


Fig. 4.—Front Flitch, or Header

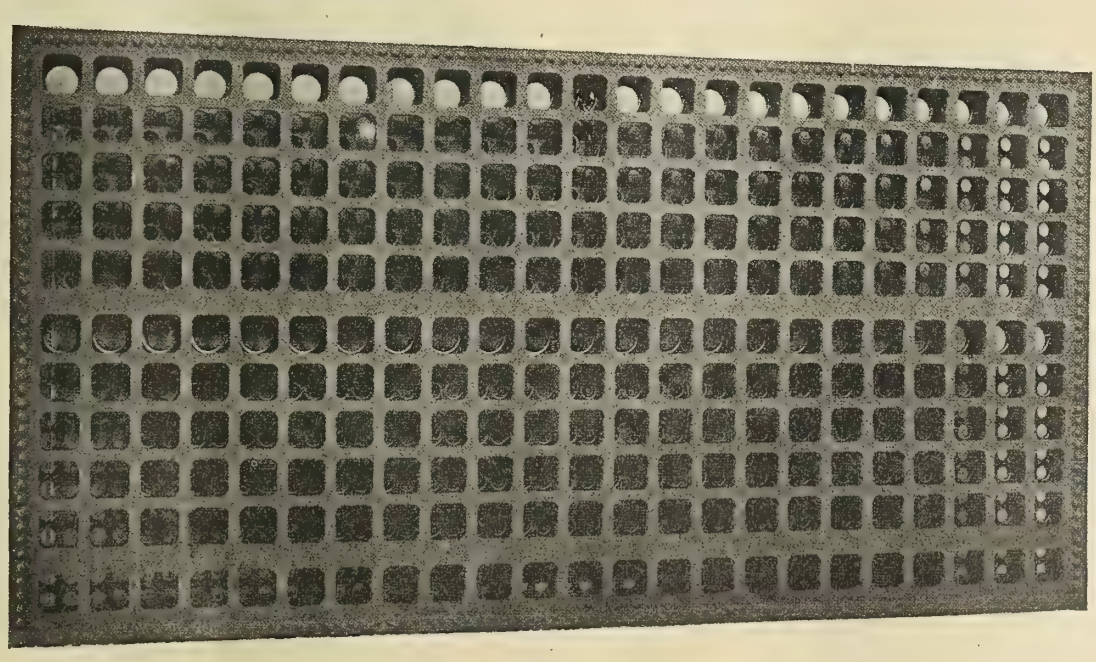


Fig. 5.—Back Flitch, or Header

near oil heater to reduce fluctuations in pressure. The oil used was Elk Refining Company's paraffine-base West Virginia oil, of the following characteristics:

Specific gravity at 60 degrees	.8245
Baume, degrees	40.1
Flash point, degrees F.	144
Fire point, degrees F.	270
Viscosity (Engler), at 60 degrees F.	9.25
Acidity	None.
B.T.U.	19,879
Sulphur	None.

Three tests were run, the first test to determine the efficiency of the boiler when burning oil at the rate of 2,300 pounds of oil per hour, the second when burning oil at the rate of 1,500 pounds of oil per hour, and the third

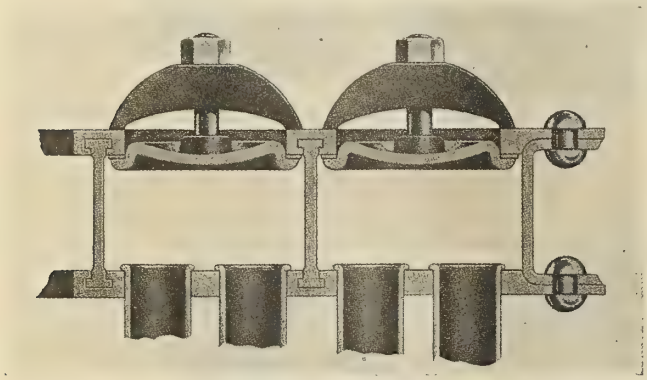


Fig. 6.—Section Through Wrought Steel Header, Showing Method of Staying the Tube and Handhole Sheets

test when burning oil at the rate of 3,100 pounds of oil per hour.

Test No. 1.—Approximate rate, 2,300 pounds of oil per hour. Test begun 5 P. M., February 7, 1916, ended 11 P. M. February 7, 1916. Seven burners fitted with 5/64-inch tips and 3/64-inch plugs were used.

Two oil pumps, two feed pumps, two feed heaters were in operation throughout the test.

There was some vibration on several occasions during the trial due to lack of care with air regulation.

There was no observable smoke during the entire trial. A small excess of air was supplied.

At 8 P. M. one feed pump broke down and operated indifferently during the remainder of run.

The casing of the boiler, especially the left side in wake of lower rows of tubes at back, became red hot in places, indicating insufficient lagging behind the brick.

Test No. 2.—Approximately 1,500 pounds of oil per hour. Test begun midnight, February 7, 1916, ended at 6 A. M., February 8, 1916. Seven burners were used. The burner used was 1/16-inch tip and 3/64-inch plug.

One oil pump, one feed pump, one feed heater were in operation.

The conditions were very steady during the entire trial. The combustion was excellent. The casing became quite hot at sides near back of boiler.

There was no observable smoke during the entire run.

At end of test boiler was let down, brickwork appeared in very good condition; the bottom appeared to be somewhat uneven, indicating that magnesia under bricks was disintegrating to some extent.

During February 8 the feed pump was overhauled. Additional asbestos millboard was placed behind metal side casing, and the brickwork, especially that on left side of boiler, was repaired.

Test No. 3.—Approximate rate, 3,100 pounds of oil per hour. Fires were started at 12.30 P. M., February 9, 1916. Data for test were taken from 1.30 P. M. Test ended 6.30 P. M. On account of insufficient time to get boiler warmed up to proper conditions, it was decided to use data for four hours, from 2.30 P. M. to 6.30 P. M. Seven burners were used. The burner used was 3/32-inch tip and 3/64-inch plug.

Two oil pumps, two feed pumps and both feed heaters were used.

Owing to lightness of oil, difficulty in forcing a sufficient amount through the burners was experienced when oil was heated. The oil was therefore not heated after the first hour. With cold oil the required amount of oil was burnt.

There was no observable smoke during the entire run.

The left side of casing became red hot during test, indicating that there is insufficient insulation in casing as built.

Synopsis of Tests

Test No.	2	1	3
Approximate rate of oil burned per hour required by schedule 7,360	1,500	2,300	3,100
Oil actually burned, pounds per hour	1,509.7	2,440.7	3,082
Pounds of water evaporated from and at 212 degrees F. with oil as fired of 19,879 B.T.U.	16.73	16.48	16.21
Reduced to 19,000 B.T.U.	15.99	15.75	15.49
Guaranteed for 19,000 B.T.U.	15.66	15.33	15.00
More than guaranteed	.33	.42	.49

Comments on Operation of Boiler

The boiler steamed freely under all the tests. The circulation is evidently satisfactory. Small propellers were placed in two of the intermediate 4-inch tubes, with a rod running through the handhole. The movements of these rods indicate a down-flow in the 4-inch tube at all rates of steaming.

After the regular test the Charles Ward Engineering Works, at the suggestion of the Board, installed propellers

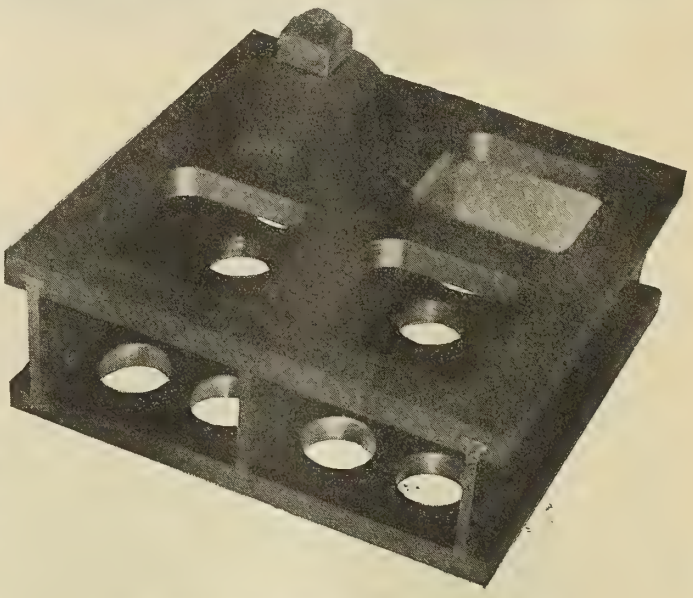


Fig. 7.—Section Showing Header Construction

in several of the 2-inch tubes to ascertain the character of the circulation. (See Fig. 2.) The result was as follows:

No. 2 began to revolve in about five minutes after the fires were started; the direction of rotation showed down-flow in these tubes. No. 1 hesitated slightly, showing some inclination to turn left-handed, which was probably due to the suction caused by the down-flowing water from No. 2. This condition changed before steam was raised, and No. 1 began to revolve in the opposite direction,

U. S. S. Destroyer *Sampson*, built by Fore River Shipbuilding Corporation, Quincy, Mass. Contract Speed, 29.50 knots; Trial Speed, 31.30 knots.

showing that the water was flowing up the lower bank of 2-inch tubes. Nos. 3 and 4 began to revolve left-handed in about ten minutes after the fires were lighted, the speed increasing until they were running like windmills, so fast that the revolutions could not be counted; the direction of rotation showed down-flow in these tubes. No. 5 remained stationary until there was about 50 pounds of steam on the boiler, and then it commenced to revolve in a left-handed direction, indicating that as soon as the water level raised on the high side of the tubes, due to the steam-making condition, there was a down-flow through the 2-inch tube mentioned.

From these experiments it is inferred that the flow is upward through all the 2-inch tubes below the middle baffle, and downward through all the 2-inch tubes in the upper portion of the boiler, the velocity being quite rapid, for, as stated, the propellers were revolving in the neighborhood of 200 revolutions per minute or more. The high velocity of the propellers in the small tubes is due to the fact that the shafts were of very small diameter and consequently there was very little friction in the apparatus.

Tabulated Results of Tests

1	Test No.	2	1	3
2	Barometer	30.79	30.73	30.55
6	Steam pressure, pounds gage	194.75	196	197.6
9	Feed temperature of boiler, degrees F	183.6	113	168.3
12	Oil pressure at burners, pounds gage	258	255	283
13	Oil temperature at burners, degrees F	163	141	50.5
14	Fireroom pressure, inches of water	2.34	4.91	4.96
15	Fireroom temperature, degrees F	62	74	64
16	Stack temperature	418	475	520
17	Smoke, Ringelmann scale	0.1	0.1	0.1
18	Carbon dioxide	12.48	12.61	13.14
19	Oxygen	3.08	2.97	1.89
20	Carbon monoxide	....	....	....
21	Nitrogen (by difference)	84.44	84.42	84.97
22	Moisture in steam, fraction of 1 percent	.616	.606	.69
23	Factor of evaporation	1.0738	1.1466	1.089
24	Pounds of water evaporated per pound of oil	15.59	14.37	14.89
27	Water evaporated per square foot of heating surface per hour, actual	5.342	7.964	10.415
28	Water evaporated per square foot of heating surface per hour, from and at 212 degrees F.	5.736	9.131	11.34
29	Pounds of oil burned per square foot of heating surface per hour	.3427	.5541	.6996
30	Pounds of oil burned per cubic foot of furnace per hour	3.17	5.125	6.475
31	Boiler efficiency, percent	81.68	80.45	79.13

To establish the volume of water flowing down through the 4-inch tube, one of the propellers was removed and installed in a short piece of pipe (as shown by the accompanying sketch), this being connected to the city water main and the propeller operated under a pressure of about 40 pounds, the discharge being throttled until the propeller made approximately the same number of revolutions as it did in the boiler. Readings from the water meter over a period of five minutes showed that there was about 50 gallons per minute passing through this tube. This, however, is only an indication of the amount of water flowing through the 4-inch tubes, as the friction on the propeller was very much greater under the higher pressure conditions existing in the boiler.

The foregoing results are very interesting, and are believed to throw a new light upon the problem of circulation in boilers of this general type of construction. They also indicate that the baffling as arranged secures the benefit of the counter-current principle throughout the boiler.

The casing as constructed is insufficiently insulated for high rates of combustion. This can, however, be easily remedied by providing additional insulation, and, if brickwork is provided with anchor bolts, injury due to panting will be avoided.

No distortion of any of the lower tubes was observed, and it is apparent that there is no difficulty in giving the lower tubes an ample supply of water.

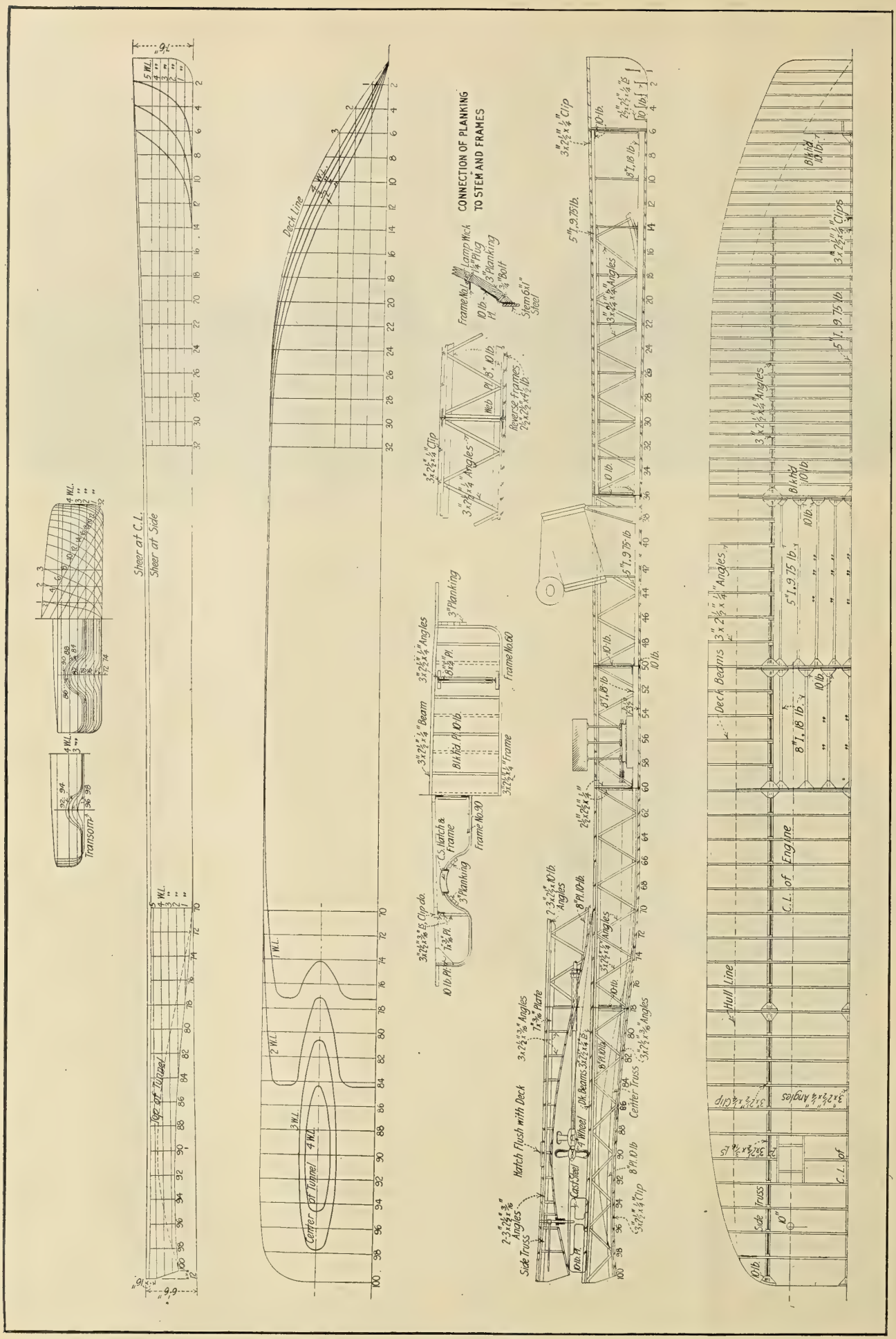
Comments on Design of Boiler

The design gives a very compact straight tube boiler with good circulation.

The baffling as arranged gives a counter flow action between water and gases through the boiler, which apparently secures very high efficiency.

The manner of staying the water chambers is considered efficient, and no trouble should be expected from the design of water chambers.

There is ample space in the header beneath the edges of the lower tubes to allow for the collection of sediment, should this be contained in the feed water.



Lines and Construction Plans of Twin-Screw Tunnel Stern Excursion River Boat

Twin Screw Tunnel Stern Excursion River Boat

The drawings on the opposite page show the lines and construction plans of a twin screw, tunnel stern, shallow draft excursion boat, 150 feet long by 28 feet beam by 5 feet depth, designed by Mr. E. O. Paterson, naval architect, Alexandria, Va., for use on the Ohio River. The boat will have a displacement of 241 long tons on a draft of 2 feet 3 inches.

Owing to the slow delivery of steel, the hull is of composite construction with steel frames and 3-inch Georgia pine planking. As the boat is not required for towing, only two rudders are provided.

Propulsion is by twin screws, 4 feet diameter by 96 inches pitch, designed to run at 250 revolutions per minute to give the boat a speed of 12 miles per hour, being driven by high pressure compound engines supplied with steam by watertube boilers.

Motor Ship Oregon

The motor ship *Oregon,* built for Det Forenede Dampskibselskab (The United Steamship Company) by Burmeister & Wain of Copenhagen, carried out her official trial trip in the Copenhagen Sound on April 15 and 17.

The *Oregon* is a sister-ship to the first motor ship for Det Forenede Dampskibelskab, the *California,* and is built to replace the steamship *Maryland,* which was built of the same deadweight capacity as the *California,* in order to get a real basis for comparison of the economy of a Diesel ship with four-stroke engines and a thoroughly modern steamship.

Unfortunately, the *Maryland* was blown up by a mine on the home voyage, but there was already sufficient results for Det Forenede Dampskibselskab to resolve to replace the *Maryland* with a motor ship.

The main engines of the *Oregon* are six-cylinder, four-stroke, single acting Diesel engines with a cylinder diameter of 23.6 inches and a stroke of 36 inches, developing as normal load 2,800 indicated horsepower at 140 revolutions per minute. Each engine drives its own main compressor of the Burmeister & Wain standard three-stage type for air injection.

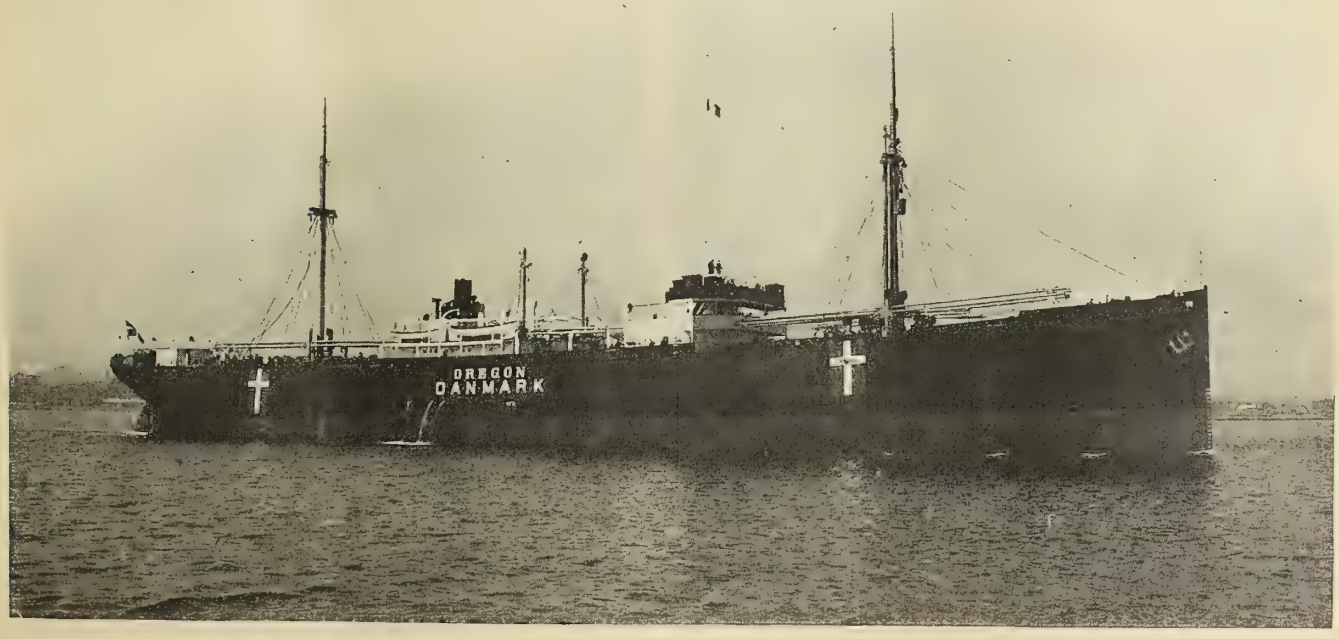
The three auxiliary Diesel engines develop each 75 brake horsepower at 325 revolutions per minute, directly coupled to dynamos of 50 kilowatts at 220 volts, all the auxiliary machinery, winches, anchor windlass and steering gear being electrically driven.

For heating purposes there is arranged a small boiler, and in connection with this a smaller auxiliary compressor, for filling up one of the high pressure air bottles if all the air should be lost on account of an error by the staff or if the ship has been laid up.

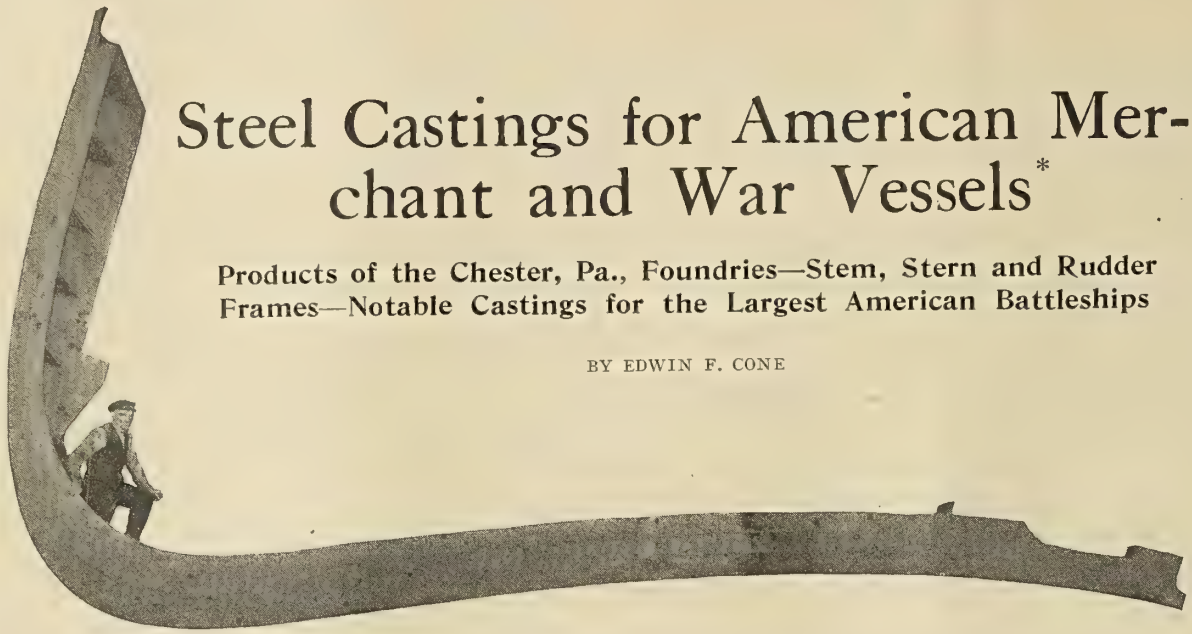
The trials on the 15th consisted of progressive runs over the measured mile, and on the 17th the fuel consumption was measured on a three-hour consumption test. A speed of 12.49 knots was obtained at 2,900 indicated horsepower and 148 revolutions per minute. As the trials were entirely satisfactory to the owners, the ship started on her maiden voyage for America on April 18.

Difficult Repair Job at Sea.—Reports from Lloyds describe a difficult piece of engineering repair work carried out by the officers and engineers of the steamer *Pukaki,* of 1,444 gross tons, owned by Messrs. William Clancy & Co., while adrift in the Pacific. The vessel was bound from Sydney to Ocean Island, and while off the island of Kusail the tailshaft of the steamer broke. The propeller was unshipped and the broken tailshaft removed, but when an attempt was made to fit the spare shaft, it was found to be ⅛ inch too large at the inboard end and ⅝ inch too large at the outboard end. After eight days of arduous labor with hand tools the shaft was fitted and the vessel proceeded to her destination. The work was carried out by Mr. W. J. Meek, chief engineer, Mr. W. Newlands, second engineer, and Mr. Williamson, third engineer.

Power Barge Service Between Philadelphia and New York.—A power barge freight service, known as the "Blue B" line, is now in operation between Philadelphia and New York via the Delaware and Raritan Canal. Daily sailings are offered and the trip is made in about fifteen hours, the barges now in use averaging 125 tons capacity. A regular schedule is maintained, a boat leaving Philadelphia and New York at four o'clock in the afternoon, except Sunday, arriving at their destinations at seven o'clock the next morning. The freight rates by water are the same as by rail.



Motor Ship *Oregon,* Built by Burmeister & Wain, Copenhagen, for the United Steamship Company



Steel Castings for American Merchant and War Vessels*

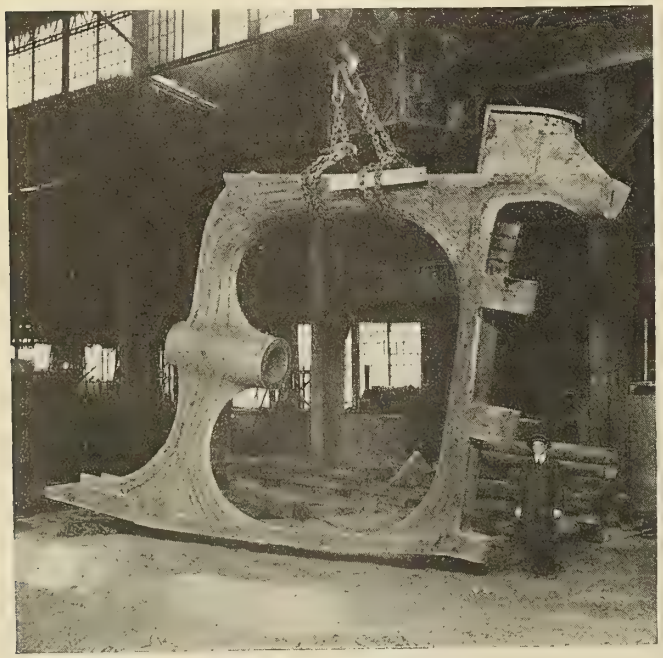
Products of the Chester, Pa., Foundries—Stem, Stern and Rudder Frames—Notable Castings for the Largest American Battleships

BY EDWIN F. CONE

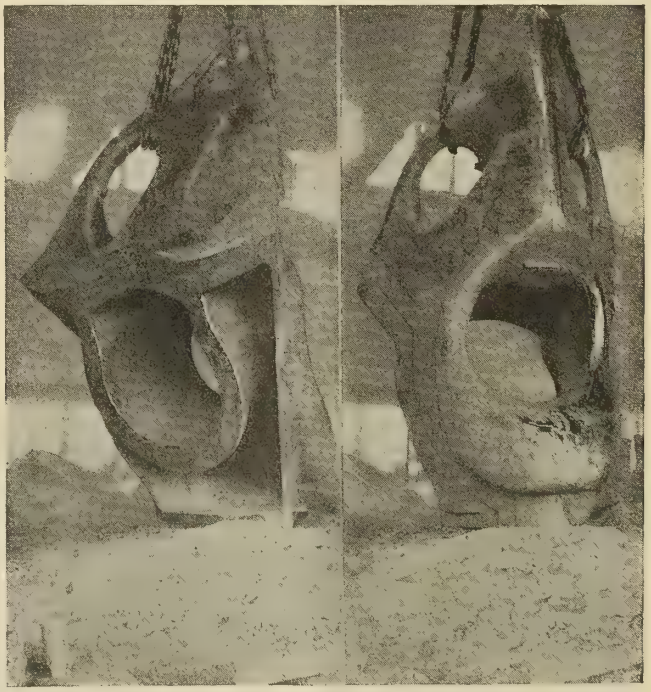
PROBABLY 90 percent of the steel castings required to build the new navy of the United States have been made in Chester, Pa. In that city are located several of the most important open-hearth steel foundries in the country. In their employ are many men who have spent their lives in the various foundries and have helped to develop this remarkable phase of the foundry business, so that this district is famous for the battleship and other ship castings it has produced, not only for our own navy, but for those of other countries. Many intricate and large castings for the present additions to the navy are still being made by Chester foundries.

Four important types of large castings enter into the construction of the modern battleship—the stern frame, the stem, the rudder frame and the struts. As the size of the battleship has increased, the design and weight of these various types have changed until to-day some of them present unusual problems and difficulties in molding and casting. In addition, those for other navies are usually different. For merchant ships the steel castings are radically different in design and weight, but not so difficult usually to produce, though there are exceptions. The latest battleships, such as the *Arizona, Mississippi* and *California,* require about 343 gross tons of steel castings; the earlier type, as the *Kentucky,* only 123 tons—a decided expansion.

* From the *Iron Age.*



Large Stern Frame for Merchant Ship



Bow Casting for U. S. S. *Idaho*

Rudder Frame for U. S. S. *Pennsylvania*

Stern Frame

Cast Steel Rudders for Merchant Vessel

The molding and casting of a battleship stern frame, or even stem, are undertakings requiring much time, care and patience. The mold for the stern frame is often made in several parts, and is always baked thoroughly in an oven. The various parts are molded in flasks which are carefully joined together, usually in a casting pit of large dimensions. The completed mold is often as large as a small-sized house. It is usually necessary to pour such castings with two ladles, one delivering metal at each end of the mold or one supplementing the other. This is necessary not so much because of the weight of the casting itself as because of the length and the fact that the metal must travel a considerable distance and fill up a comparatively thin space. The stem and rudder frame are usually made as one casting, but the stern frame as two, though a few years ago it was poured in one mold.

Grade of Metal Used

The steel for such castings is almost universally acid open-hearth and of the best quality possible. Special care is taken in selecting the charge and in finishing the steel, because the design of a stern post in particular is such that it may easily crack or develop defects that will not pass the very severe United States Government inspection. Until recently all such castings were made of mild steel hving a carbon content of 0.25 to 0.30 percent, with a tensile strength of 60,000 to 70,000 pounds per square inch. But in recent years the tendency has been to make a stern frame or stem lighter in weight, and therefore the metal now prescribed is 0.40 percent carbon steel with a minimum strength of 80,000 pounds per square inch. The chemical requirements otherwise call for manganese, 0.60 to 0.70 percent; silicon, 0.25 to 0.30 percent; sulphur and phosphorus not over 0.05 and 0.06 percent, respectively. In the case of the higher tensile strength metal an elastic limit of not less than 45 percent of the tensile strength is required, a minimum elongation of 17 percent in 2 inches, and a minimum reduction of area of 20 percent. In the case of the mild steel an elastic limt of not less than 45 percent of the registered tensile strength is demanded, as well as a minimum elongation in 2 inches of 22 percent and a minimum reduction of area of 25 percent—not a difficult specification to meet where foundry and furnace practice is progressive. In any case the steel must be very hot and uniform, the two heats which are tapped simultaneously being as near alike chemically as possible.

The pouring itself is not a simple proposition. In casting 25 tons from each of two ladles into one mold extreme care and skill are necessary, because an accident of any kind is expensive. The loss of the entire casting by a break-out of metal from the mold has occurred more than once with spectacular results. When it is considered that the molding of such a casting takes often two months and more and the metal consumed often as much as 35 to 40 tons, the financial loss is a large one.

The cleaning of such a casting is an expensive undertaking. After it has remained in the flask ten days to two weeks it is removed to the cleaning department, where sink heads, often equal in weight to the weight of the casting, are removed.

The annealing must be thorough. It is a difficult process, requiring a large and efficient annealer. Satisfactory heat treatment always involves slow heating to a temperature above the recalescence point and then slow cooling in the closed annealer. The structure thus obtained is always pearlitic. While a sorbitic structure, resulting from quick cooling, would greatly improve the static properties of the metal, the consequent internal strains and warping of the casting would be serious.

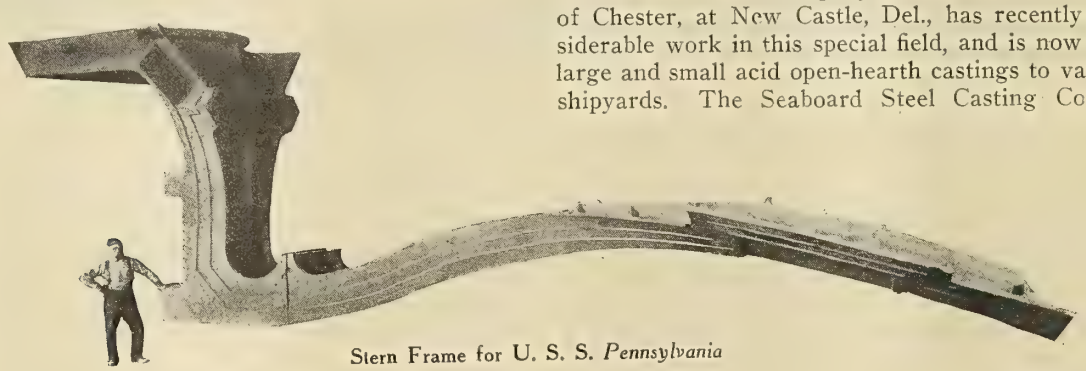
Besides the four types of large castings for battleships, many important and by no means small steel castings are

Stern Frame for Argentine Battleship

required in the construction of a modern battleship. The turbine driven ship has developed the need of a cast steel turbine wheel, very large and intricate, calling forth the ingenuity of Chester's skilled labor. In addition there are many important hull and engine castings, such as hawse pipes, bed plates, pistons, etc., each requiring annealing, physical tests and exacting surface inspection by the Government before acceptance. The development of the large gun turrets has called for large turret roller castings, made in segments of a circle and of high carbon steel. For the large 14-inch navy guns an important yoke casting of nickel steel is now made in Chester which was formerly a forging.

The Large Foundries Making Ship Castings

Three large Chester steel foundries now specialize in battleship castings. Two of these have been the pioneers in this work since the new modern United States navy was started late in the 1890's. They all constitute a group different from any other foundries in this country



Stern Frame for U. S. S. *Pennsylvania*

as being the only ones where such work is successfully and continually done. The pioneers in this class of work were the American Steel Casting Company, since 1902 the Chester plant of the American Steel Foundries, and the Penn Steel Castings & Machine Company.

The third foundry of prominence which has specialized in these castings is the Federal Steel Foundry of Chester. It is owned by the Cramp Ship & Engine Building Company, but it also produces castings for other shipyards. At present it is furnishing important castings for the battleship *Idaho,* being built by the New York Shipbuilding Company, Camden, N. J.

This foundry has not been long in existence, and it differs in its product in one important particular. It makes its steel in a basic open hearth furnace, but it uses high grade scrap, such as is used in acid open hearth furnaces, and it pours the same kind of castings as made by the acid foundries.

A metallurgical advantage claimed is that the steel is better than regular basic steel in that less refining is necessary because starting with purer stock; that a better and tougher steel than from the acid furnace using the same stock is obtained; that it is cheaper, and that it is lower in both phosphorus and sulphur than the acid metal and less liable to be defective when cast.

The character of the annealed metal produced by this foundry is indicated by the composition and physical properties of this casting, which are as follows:

Carbon, 0.35 percent; manganese, 0.68 percent; silicon, 0.338 percent; sulphur, 0.041 percent, and phosphorus, 0.025 percent.

Tensile strength, 83,750 pounds per square inch; elastic limit, 43,750 pounds per square inch; elongation in 2 inches, 24 percent; reduction of area, 37.9 percent; cold bend of 1 inch by 0.5 inch bar, 140 degrees.

It will be noticed that the 80,000 minimum tensile strength specified by the Government for this casting has been met, not by aiming at 0.40 percent carbon, but by using a lower carbon and a higher manganese metal—a practice which insures a strong and tough metal.

It is contended that this exceptional furnace practice is the cause of success. It is at least true that it has been generally accepted that castings requiring final machining nearly all over could only be made successfully from acid open-hearth steel.

While the output of this company is not as large as that of the two others—about 800 tons of finished castings per month as compared with 1,800 to 2,000 tons—it has produced and is producing now nearly as large and difficult castings as those already mentioned for both United States navy and merchant ships.

Other Foundries of the District

The Baldt Steel Company, located about 20 miles south of Chester, at New Castle, Del., has recently done considerable work in this special field, and is now furnishing large and small acid open-hearth castings to various large shipyards. The Seaboard Steel Casting Company, of Chester, a large open-hearth plant, in its early history made a considerable number of Government and merchant castings similar to those described, but reecntly has confined its efforts more especially to other lines of work. For every battleship there are a great many small steel castings, nearly all of which the large foundries used to produce, but in recent years these have been made by the smaller foundries. Conspicuous among these is another Chester foundry, the Eagan-Rogers Steel & Iron Company, which has a large output of converter castings.

Before the advent of steel castings for such parts as stern frames and stems these were made of wrought iron. In fact, to-day this metal enters quite extensively into the construction of merchant but not Government work. Many of the earlier wrought-iron forgings for this class of work were made by McPherson & Willard, now the Bordentown Forge & Machine Company, Bordentown, N. J. The Reading Iron Company, Reading, Pa.; the Cleveland City Forge & Iron Company, Cleveland, Ohio, and the Delaney Forge & Iron Company, Buffalo, N. Y., also made these earlier forgings, and the latter company still makes them.

A striking feature of the foregoing development has been the lack of inclination to use anything but plain carbon steels. None of the alloy steels has made any incursion into this field, whereas in locomotive construction vanadium steel castings are widely used.

The future holds out much promise for the increasing importance of these and other foundries in naval and merchant marine development. New foundry problems will arise and new types of castings will be called for, but it need not be doubted that all such demands will be fully met.

Fig. 1.—S. S. *Eurana*, Equipped with De Laval Turbine Reduction Gear

The Steam Turbine on Board Ship

Application of the De Laval High Speed, Double Helical, Speed Reducing Gears to Turbine Drive on Board Ship

IN the last few years the steam turbine has practically displaced the reciprocating engine for large powers on land, for obvious reasons. The steam turbine permits of much larger units than are feasible with reciprocating engines; it reduces the cost of buildings and foundations; it is free from vibration due to heavy reciprocating parts; it shows better steam economy; it is much more reliable and more easily operated than a reciprocating engine, having fewer wearing parts, with a relatively simple lubricating system; it is able to utilize the highest vacuum to good advantage, and the condensate is pure distilled water containing no oil and is, therefore, safe for use in the boilers.

All of these advantages apply with even greater force to steam turbine installations for marine service, but until recently the steam turbine has been used principally in high speed vessels, usually of large size, and in most cases the turbines were directly connected to the propeller shaft.

Owing to the wide difference between the turbine speed necessary for the highest efficiency and the proper propeller speed, direct connection of steam turbines to propellers requires a compromise speed which is not suitable for either the turbine or the propeller.

For slow-speed, cargo-carrying boats, where the propeller speed in most cases does not exceed 125 revolu-

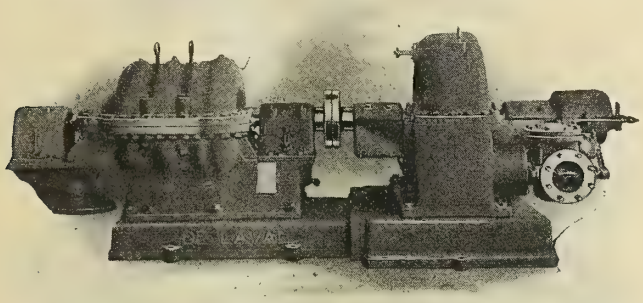


Fig. 2.—De Laval Three-Stage Centrifugal Boiler Feed Pump, Directly Connected to De Laval Velocity-Stage Steam Turbine

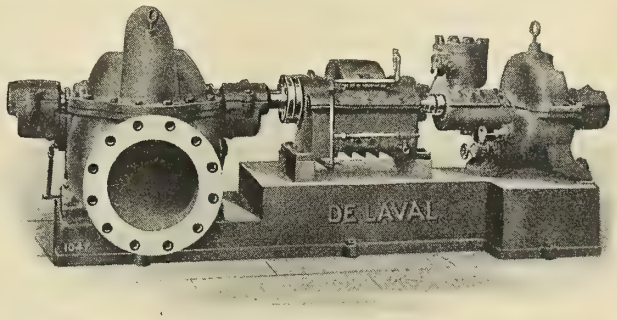


Fig. 3.—Steam Turbine Driven Centrifugal Pump for Circulating Condenser Water; 5,500 Gallons per Minute Against 25-Foot Total Head

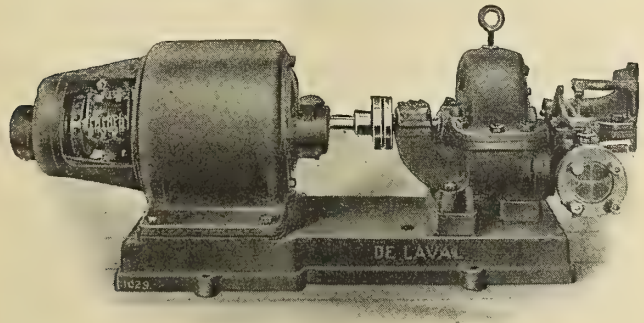


Fig. 4.—Small Auxiliary Lighting Set, Consisting of Direct-Current Generator Driven by Velocity-Stage Turbine; 10 Kilowatt at 3,600 Revolutions per Minute

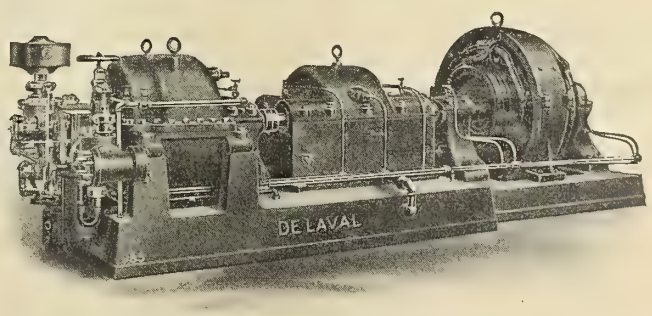


Fig. 5.—De Laval Geared Steam Turbine Driving D. C. Generator on U. S. Battleship *Arizona;* 300 Kilowatt

tions, it is obvious that direct connection of the turbines to the propeller would be impracticable. The logical solution, therefore, is to interpose speed reducing gears between the turbine and the propeller, which will permit both the turbine and the propeller to run at their most efficient speeds. The introduction of reduction gears greatly reduces the weight and size of the turbine and permits of its being designed for the highest efficiency, while the losses in the gear are negligible. The greater simplicity of this type of propelling unit, as compared

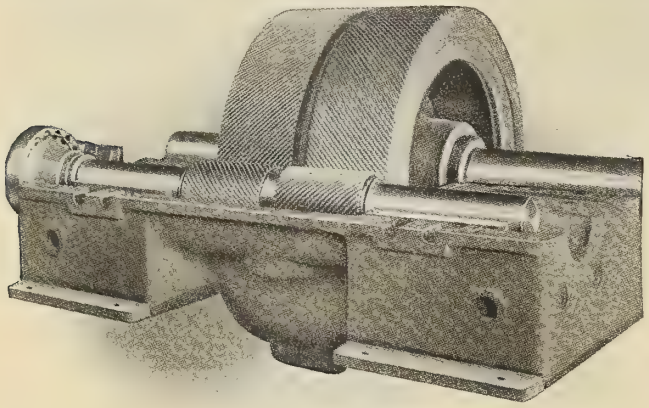


Fig. 6.—De Laval Double-Helical Speed-Reducing Gear, With Casing Cover Removed, Showing Fixed Invariable Supports for Both Gear Shaft and Pinion Shaft

with the reciprocating engine, greatly reduces the expense of maintenance and gives a much higher overall efficiency than is attainable with the reciprocating engine.

Great flexibility of design is also possible, depending on the requirements of the installation, it being possible to design the turbine for moderate capacities in either one or two casings per propeller. By installing two turbines —one a high pressure turbine and the other a low pressure turbine, each turbine provided with its own pinion operating on the gear connected to the propeller—a substantial duplication of driving machinery is obtained, since either half of the turbine can be operated independently on boiler steam, if required, and the highest possible efficiency obtained.

The De Laval Steam Turbine Company, of Trenton, New Jersey, which for over twenty-five years has been engaged in the development of high speed double helical, speed reducing gears for steam turbine service, is building a number of large gear reductions for marine service. One outfit under construction consists of two 2,500 horsepower reduction gears to be installed in a twin-screw freighter. Each unit consists of two pinions operating at 2,200 revolutions per minute on one gear running at 110 revolutions per minte. The De Laval Company is also supplying the gears for two 17½-knot, 10,000-ton passenger boats. These vessels are 450 feet long and are twin-screw vessels, each screw requiring 4,500 horsepower. The gear reduction for each propeller consists of two pinions operating on a main gear, the pinions running at 1,500 revolutions per minute and the gear and propeller at 120 revolutions per minute. For each reduction, one pinion is operated by a high-pressure turbine and the second pinion by a low-pressure turbine.

Four De Laval gear reductions are being supplied for two destroyers for a foreign navy, each reduction being designed for 5,500 horsepower, at a turbine speed of 3,600 revolutions per minute and propeller speed of 450 revolutions per minute. Two 9,500 horsepower gear reductions are being built for a destroyer under construction for the United States Navy.

An essential feature of the De Laval reduction gear is the use of gears and pinions rigidly supported in the casing. This construction is necessary, as any resiliency or flexibilty between gear and pinion results in unequal pressure and wear, and the proper and only effective means of insuring smooth, quiet running and long life are the use of the proper methods for producing the correct pitch, tooth angles and tooth contour. To this end the De Laval Steam Turbine Company has developed special designs of gear cutting apparatus and methods of cutting, and claims that the success being obtained in the daily service by the many large gear reductions of their manufacture in all classes of service proves the correctness of their design. If rigidly supported, gear teeth which have been correctly formed in the first place proportioned to give moderate tooth pressure will retain their orignal correct contours and will operate noiselessly, efficiently and without vibration at the speeds necessary for steam turbine-geared service.

The De Laval double helical gears are cut upon special machines designed and built by the De Laval Steam Turbine Company for the purpose. After cutting, each gear is tested for correct angle, correct shape of teeth and correct pitch, and no gear is used which does not have a perfect contact surface for the whole length of every tooth. No scraping or hand work is permitted on the tooth surfaces, since such hand work produces imperfect contours; and after cutting, the gear teeth are carefully polished by special processes to eliminate the small in-

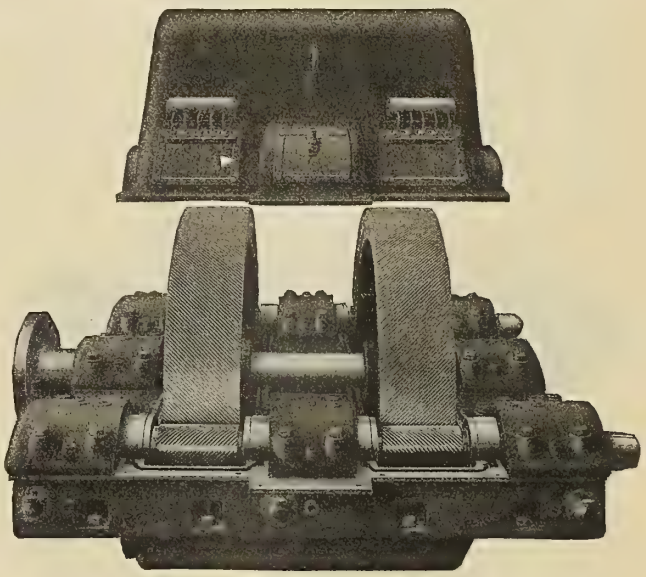


Fig. 7.—De Laval 4,500-Horsepower Marine Reduction Gears

equalities left by the cutting tools, without in the least degree altering the profile of the teeth.

The gear teeth are cut upon seamless rolled steel bands shrunk upon either a cast-iron or cast-steel center, as conditions may require. The gear bands are of special steel, heat treated. The pinions are cut directly on the pinion shaft, which is a special chrome-nickel steel forging, oil-tempered to have a hardness much greater than that of the gear bands, in order to provide different qualities of metals in contact and to insure long life of the pinion. The entire gear, after assembly, is carefully tested for static and running balance.

(*Continued on page* 346.)

Letters from Marine Engineers

Discussion of the Design and Handling of Marine Engines, Boilers and Auxiliaries—Breakdowns at Sea and Repairs

This department is open to all readers of the magazine for the discussion of affairs in the engine room. All letters published are paid for at regular rates. Your ideas or experiences will be mutually helpful and interesting to other engineers. Write your letter now.

Should the Hydrostatic Test Pressure of One and One-Half Times the Working Pressure be Applied to Marine Steam Boilers Annually?

After an experience of thirty-seven years of service on the Great Lakes, I am of the firm opinion that a hydrostatic test applied to boilers annually at a pressure not exceeding one and one-half times the steam pressure and at a temperature not exceeding 100 degrees Fahrenheit does not injure the boilers as constructed for the lake trade. I have never known nor heard among my acquaintances, extending from Buffalo to Duluth and Chicago, of any injury being done to either boilers or fittings. In regard to the advisability of applying the hydrostatic pressure for the purpose of ascertaining the defects and weaknesses of the boiler, I would say that this test alone will not bring about the desired result.

As a rule, the owner of the boilers does not seem to realize the necessity of having his boilers in readiness for this annual inspection. I have in mind a manager of a fleet of small steamers who viewed the annual inspection with much worriment. Invariably staybolts would be broken, sheets sprung, and a delay of a week or two, or a month, to one or more of his steamers would occur. After he had been advised to see his boilers were in proper condition, that all broken and defective staybolts should be renewed so that when the hydrostatic pressure would be applied no undue strain would be thrown upon the sheets and adjoining braces and staybolts, his troubles disappeared. His method of procedure now is to have a boiler maker go through the boilers every washout day. Any defects are immediately repaired and for the last four years none of his steamers has been delayed on account of the annual inspection. His worriment has also ceased, and he is now of the firm opinion that the hydrostatic test is a good one. It has a corrective influence upon him and his employees and they now know that no excuse will be accepted for any defect found in the annual inspection.

As before stated, the hydrostatic test alone is possibly only thirty to forty percent of the required inspection of the boiler. The examination of the interior of the boiler to determine its cleanliness and the condition of deterioration by disinterested parties to determine its safety is the other remaining percent. The boiler should be washed clean and all soot removed from tubes, sheets and furnaces and no delay should occur other than the time necessary to wash out the loose mud and the soot from the tubes. This interior examination again calls the attention to the owner to the necessity of having the repairs needed to keep his boiler in a safe condition done at a time most convenient to himself and in advance of the annual inspection. In other words this delay to the steamer which is the cause of so much complaint can be avoided by the owner himself taking the proper precautions. The writer can see no reason why the steamboat should be delayed other than the actual time required to make the inspection, if the owner of the steamer will take ordinary precaution to see that his boilers are in safe working condition at all times. The complaint made by many parties regarding the disastrous results to valves and fittings, joints and piping, caused by the application of the hydrostatic pressure test annually is not well founded and can only come through inattention on the part of the engineer in charge or the desire of the management to economize to the point of danger. It is the firm belief of the writer that any main stop valve, auxiliary stop valve, slip joint, throttle valve or line of pipe or flanges connecting same, that would show a weakness or excessive distortion upon the application of one and one-half its working steam pressure should be condemned from further use by the management of the steamer themselves.

A boiler can be severely injured after applying the hydrostatic test or filling the boiler with fresh water after cleaning out by getting steam up too rapidly without the proper circulation. Circulators should be installed in all boilers to assist in the firing up and getting up of steam. A clear case of haste makes waste.

The idea that a boiler has a pressure of only that shown by the steam gage when in operation is an open question. Authorities have not yet agreed how much reaction comes upon the boiler when the engine is working at regular speed, when suddenly put into full speed astern or being worked at a high rate of speed. Attention is here called to the fact that we have many instances of what is known as the breathing action, particularly noticed in our wrapper sheets and our back connections. Broken screw staybolts have been removed from wrapper sheets and the broken ends found to be as smooth as a diamond. This is only one of many proofs. The opening of the steam valve to the engine twice in every revolution, the sudden withdrawal of steam from the boiler and then the immediate closing of said valve to cut off at from half to three-quarters stroke, allows an interval when no steam is withdrawn from the boiler. The result must be a series of recoils; in an engine turning ninety revolutions per minute this brings over ten thousand shocks per hour. As before stated, authorities do not agree in this matter, but still the subject is worthy of serious attention.

Our Scotch marine boilers on the lakes are now approaching an age of thirty years, during which time they have been in operation a little over half that period, so that it would seem to be a poor time to relax in safeguards. It is, of course, understood that those holes in the ends of staybolts drilled half an inch beyond the thickness of the sheet are a good safeguard and give warning, when the bolt has broken, by the steam escaping through the hole. The law requiring this was put into effect in 1898 and the safety of the boiler depends largely upon these holes being kept free. A bolt may be one-half or two-thirds broken under working conditions, and at the time of the hydrostatic pressure being applied the remaining portion will break and warning be given

by said tell-tale hole. The hydrostatic pressure can be immediately stopped and the proper repairs made before applying the full hydrostatic pressure.

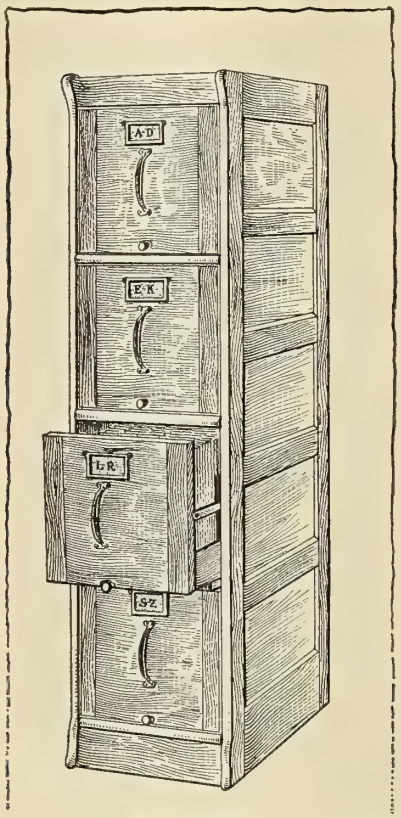
To those boilers that were built before 1898 the hydrostatic pressure still more strongly applies and the hammer test of these bolts that have no tell-tale holes in them can more properly be carried out by having a hydrostatic pressure of about the working pressure. This pressure pulls the sheet away at the point of the broken staybolt and the hammer test can then positively determine if the bolts are broken.

In conclusion, the writer can see no objection to, and most heartily recommends, this pressure test. In the building up of the inspection work from the condition in which it was some years ago, much complaint has arisen. The past ten years have been largely educational to the owner and he has been taught by the delays to his steamer that it amply repays him to have his equipment in proper condition at the time of inspection.

YE OLD CHIEF.

Data Filing System

In response to your suggestion of a few issues ago, I submit the following brief outline of a filing system which I developed and have used for some years. I lay no claims to either consistency or logical arrangement but



Filing Cabinet

simply give it as one which has gradually been built up to suit my needs and one which serves my purpose well.

It is used primarily as a means of filing clippings from the engineering press, abstracts from the proceedings of the various engineering societies, reports, personal computations, photographs, etc., but actually, in practice, it is omnivorous. This very feature of being able to take articles from publications which differ widely in size of page, character of paper, etc., made it highly desirable to have some form of envelope or container for the groups of clippings which should have a uniform exterior yet be able to take all forms of data. The best medium was found to be simple manilla folders, cap size (9½ inches by 15 inches when folded), envelopes proving inconvenient of access. In these folders are placed the data and the upper left-hand corner labeled with the letters for identification in accordance with the system to be enumerated later. The folders are then filed vertically in one of the standard forms of transfer cabinet used for office correspondence (see sketch) and are divided by cardboard tab cards with the legends of the subdivisions and their letter abbreviations in the left-hand corner.

The system of subdivision is a double literal one, the first letter indicating the major division and the second giving the sub-divison. To facilitate memorizing, the divisions and subdivisions have been indicated by letters the same as the initial letters of the subject in so far as possible. In some cases a further subdivision is used and indicated by three letters. In the following are only those divisions which have data actually filed in them, the intermediate letters being available for future expansion.

There is no indexing of the individual articles; but there is a card index of the system, so that if I want a subject I can find the letters representing it and at once go to the cabinet and pick out the folder which has all the data on that subject.

MAJOR HEADINGS

A—Administration.
B—Materials of Construction.
C—History.
D—Resistance and Propulsion.
E—Educational.
G—General Description.
H—Hull.
I—Instruments and Tools.
L—Life Saving.
M—Machinery.
P—Propellers.
R—Research.
S—Shipyards.
W—Wrecks.
X—Aeronautical.
Y—Yachts.

TYPICAL SUB-HEADINGS

A-C—Contracts
A-H—History
A-O—Operation
Etc.

A-O-C—Costs
A-O-L—Ship Lines
A-O-T—Terminals
Etc.

B-T—Testing
Etc.

D-T—Towing Tanks
Etc.

E-A—Apparatus
E-E—Examinations
E-H—History.
E-O—Operation

E-P—Problems
E-R—Description
E-T—Theory
Etc.

H-C—Construction
H-D—Design
H-E—Equipment
H-M—Maintenance
H-S—Specifications
H-T—Theory

H-C-B—Bulkheads
H-C-C—Costs
H-C-D—Decks
H-C-F—Framing
Etc.

G-A—Sailing Ships (Auxiliary)
G-B—Barges

G-C—Channel
G-D—Dredgers
Etc.

I-C—Construction
I-D—Design
I-H—History
I-O—Operation
I-R—Description
I-T—Theory

I-O-H—Horsepower
I-O-M—Mathematical
Etc.
I-R-F—Furnace and Flue
I-R-H—Horsepower
Etc.

M-A—Auxiliary
M-B—Boilers
M-D—Design

M-A-A—Air Compressors
M-A-B—Blowers
M-A-C—Condensers
Etc.

M-E—Engines
M-B-C—Construction

M-G—General	M-B-D—Design
M-H—History	Etc.
M-L—Lubrication	M-E-B—Balancing
M-R—Reduction Gear	M-E-C—Construction
M-S—Specifications	Etc.
M-T—Turbines	M-T-C—Construction
M-W—Weights	M-T-D—Design
	Etc.
P-C—Construction	R-E—Experimental
P-D—Design	R-H—History
Etc.	Etc.
S-C—Cranes	S-C-C—Cranes
S-D—Docks	S-C-D—Docks
S-H—History	Etc.
S-O—Operation	S-D-R—Drafting Room
S-R—Description	Etc.
	S-D-T—Tools
	Etc.
	S-O-A—Accidents
	S-O-L—Launching
	Etc.
W-H—History	X-D—Aero Design
W-R—Description	X-W—Aero Wind Tunnels
W-S—Salvage	
W-T—Theory	
Y-C—Construction	Y-C-C—Cruising
Y-D—Design	Y-C-H—Houseboats
Y-E—Equipment	Etc.
Y-H—History	Y-D-G—General
Y-M—Machinery	Y-D-M—Motor Boats
Y-O—Operation	Etc.
Y-R—Description	Y-E-R—Racing
Y-S—Specifications	Y-E-S—Sails
Y-T—Theory	Etc.
	Y-M-M—Motor Boat Engines

The above list simply represents a few typical groups of sub-headings, and of course in practice this list is expanded to include all subjects pertaining to marine engineering and shipbuilding. ENGINEER.

Lubricating Bearings

In this article it is not proposed to deal with the lubricant itself but with the bearings in which the lubricant is used and the means or methods of getting the lubricant to the bearings.

The general theory of lubricants is that in their use a film of oil or grease is interposed between a moving member and a stationary one. This, I believe, is just one-third of the real facts. Some rather crude experiments convince me that there are, broadly speaking, three films of oil, one which clings to the moving member with more or less tenacity, a second film which clings more persistently to the stationary member, and a third, or neutral, acting between these two. All of these films partake of motion and their speed is never the same. Sometimes unusual and inexplicable action is found in lubricants, but when conditions are carefully considered an explanation is sure to be found, and the mystery so often attributed to the uneven action of oils can be explained. The following is a case in point:

The bearing of a machine gave trouble. It was about 8 inches long and carried a steel shaft about 5 inches in diameter. The bearing itself was of composition of unknown mixture and the work it had to do was quite severe. In order to keep it going without overheating the bearing had to be scraped and touched up about twice a month. After such treatment on one occasion the bearing ran cool for over a month. No change in lubricant had been made and the gain was attributed to a new hand who had done the scraping having been more particular with the work, but the same man touched up the bearing again and to everybody's disappointment no gain over the usual conditions resulted.

Investigation finally proved that this was the cause of the longer run; the new hand, the first time he scraped the bearing, smeared the surface of the shaft with Prussian blue, as is quite usual. In his haste to get the machine going he did not wash off this Prussian blue, consequently this surface evidently had a tendency to hold the lubricant and this prevented the oil from running out as easily as it had done before and formed a better clinging surface than did the steel itself. Whether this is the exact reason may be questioned, but several trials proved that when the Prussian blue was left on the shaft the running condition of the bearing was maintained for a longer time than when the Prussian blue was carefully removed.

Originally the lubricant was applied directly to a bearing and gravity and viscosity did the work. Little care was taken to protect the oil opening from dirt and dust, and with the slow moving machinery of the past the demand for improvement in this matter of cleanliness was slow in coming. Oil cups with covers then made their appearance; and these being tight, a step in advance in lubrication was made. The lubricant, however, in the early forms of application could not be seen and the sight feed oil cup marked another great advance, as while a drop feed had been used in certain positions in engines and other machines the drops were not under control and were often so placed that the wind blew the drops in all directions. The sight feed cup made it possible to see that the oil started for the bearing but it did not insure its arrival, and here is the great advantage of what is known as the forced system of lubrication now being almost universally adopted.

This forced system of lubrication cannot be traced to its origin as far as I have been able to find out. A gentleman by the name of Girdwood, a Scotch engineer, told me as far back as 1876 of having applied it in a Tange engine, which he designed, and which was, according to his statement, the first overhung cylinder engine ever built. He described the system which he applied as a tank hung from the ceiling at a height which gave a pressure of about four pounds to the main bearings and guides, but the crank brasses were lubricated by a wiper cup.

The next engine that I heard of which was fitted with a system of forced lubrication was built in Essen not far from the date given and was the first time that I ever heard of where all bearings were under pressure. Neither of these systems or engines did I personally see, but later I saw a number of engines fitted with the Essen system (if it may be called so properly), and I fitted a number, supplying them to the United States Navy for blowers with the same system which eventually proved perfectly satisfactory. It may be described as follows:

The crank shaft is drilled out so as to allow the oil to pass through the center up through drilled holes in the crank cheeks to the crank pin outlets, from the central drilling or oil passage to the main bearings. Outlets are provided, the hole in the crank pin providing means to lubricate the pin and a surplus of oil is forced down the connecting rod to the crosshead pin and guides. If the engine was double the oil passages were continued on through the crank shaft to other bearings. This, of course, demanded an absolutely closed engine in order to preserve the oil which was copiously provided by means of a single acting pump directly connected to the engine.

This system has failed in quite a number of cases, known to me, the failures being generally attributed to the fact that as the oil is forced along through the oil passages, should the first bearing encountered be loose, the oil finds its way out so easily that the pressure is reduced on sub-

sequent bearings, resulting in an insufficient supply of oil. While it is a self-evident fact that the conditions noted would cause trouble, a little care on the part of those running the engines will overcome the objection and good results will be obtained. There is, however, another way of overcoming the difficulty and that is to grade the sides of the oil ducts in the shafts, beginning by making them as large in diameter as possible and reducing them in area as they are carried on. Not giving attention to this varying of size has often given trouble in forced lubricating systems.

The real objection to this system is that it is not possible to see or feel if the lubrication is being completed, and the passages are extremely difficult to clean; in fact, cannot be cleaned without entirely dismantling the moving parts of the engine. Again, this system demands somewhat higher pressures than other systems.

A second system of forced lubrication may be termed a trunk line system. Here the oil is pumped into a large tube from which branches are led to the various parts requiring lubrication. This system, if it is properly applied, is more satisfactory than the one previously referred to because it has the very great advantage of allowing either a visual or a touch system to be employed, either of which will indicate whether or not the oil has reached its destination. And further, by the use of tees instead of elbows, and crosses in the main line the oil duct can be cleaned by blowing out by steam or swabbed out by waste and wires.

In any system of forced lubrication the fundamental idea is to force a large quantity of oil to the bearings, reclaim this oil and use it again. Before oil can be reused, under these conditions, it should be strained, cooled and allowed to subside; and the subsiding is of great importance, as no system of straining that I have ever seen will remove the very small particles of dirt as does the subsiding tank, and this subsiding must be given time.

I have referred to sight feed cups, and they, on a gravity feed system, are admirable, but when it comes to a forced system of lubrication glass openings, in my experience, soon become opaque and useless. In their place I devised and used methods by which the flow of the oil could be felt, but let me say that I have always preferred a single acting pump in connection with feeding oil, as it is the pulsation resulting from it which allows one to feel whether the oil is flowing in the tube or not. The simplest form of "feel" indication is to file the tube sufficiently thin in one part to have the stroke of the pump felt through this thin wall, and it is easy to conceive without further explanation how this system can be applied almost anywhere.

No matter how the oil is supplied to the bearings the point of entrance for the lubricant is worthy of study, and usually it is not in its proper position. It should be remembered that oil has no idea or desire to be accommodating. It is lazy and will take the easiest means possible to escape from fulfilling its mission. It will never work in toward the center of a bearing; it will always work out. It is, therefore, clear that the lubricant should be introduced in the middle of the bearing, but in a reciprocating type of engine or machine this central opening should never supply the oil to the highest point of the shaft or at its lowest point as the up and down stroke of a machine closes the openings, if at the top or bottom, thus preventing the in-flow of oil at the very moment that it is needed. The oil should be introduced, therefore, at a point about midway between the center line of the shaft and its extreme diameter. In a continuous rotating shaft and in one that revolves constantly in the same direction the lubricant should be introduced midway between the center line and the diameter of the shaft, but on the up-coming side, as this is the point above the horizontal center-line of the shaft where there is the least pressure. I have many times seen troublesome journals entirely cured by merely changing the oil supply opening as here suggested.

There seems to be but one danger in the automatic or forced system of lubrication and that is that it works so well that it is apt to be neglected, with the most disastrous results. Yet this can hardly be called the fault of the system. Further, I have heard it objected to because it allows too much leisure to the men on watch. One superintendent on a steamship line assured me that he would rather have his men going around with a squirt can filling oil cups than to be sure that all his bearings were running cool by the use of forced system of lubrication.

W. D. FORBES.

New London, Conn.

The Allen Dense Air Ice Machine

When I took charge of the ice plant here, which consists of an Allen dense air ice machine of three tons capacity, I had had no experience with this make, so I let well enough alone, as the pressure seemed to be right and the machine seemed to be running well. Although the temperatures in the storage were not all that was desired, there was as yet no time to experiment while in tropical waters.

However, within a few days the compressor piston broke. Fortunately a piece of cast iron of proper size was found aboard and a new piston was machined in the ship's machine shop. This metal did not seem as good as the broken one and a piece of steel was secured and another was begun, which was not quite completed when the other broke. This was hurried and soon finished, while all clearances were taken to assure that the piston did not strike, causing it to break. Now as the time was valuable the piston was packed and the machine started again. This was done without the loss of any meats that were in the storage at the time, although the temperature did rise to 34 degrees by the time the machine was started again.

Soon it was noticed that the compressor cylinder was walking and it was remedied by setting down on the holding-down bolts and tapping down the dowels.

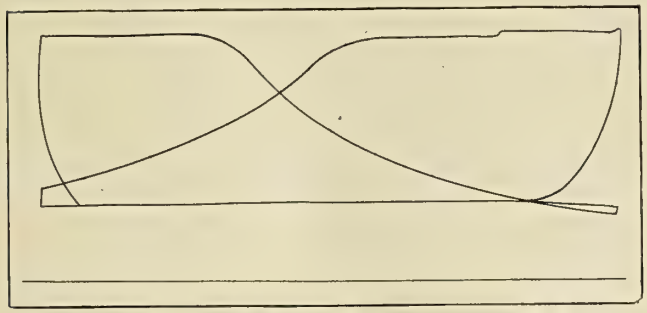
Later a piston rod (compressor) snapped at the base of the threads on the crosshead end. Upon renewal of the rod the machine seemed to be working finely, when within a few days the crosshead broke where the piston rod screwed in and as a spare was on hand it was soon replaced.

Not much later opportunity presented itself to overhaul the entire machine. Upon opening the compressor valve chest it was found that valve seat was scored very badly and as the cylinder had to be removed to machine the seat down for fitting a false seat, just before removing the cylinder a line was run to see if the cylinder was out of alinement. It was found to be out both as to square and not in alinement with the shaft. The exact amount cannot be given, as the figures were lost.

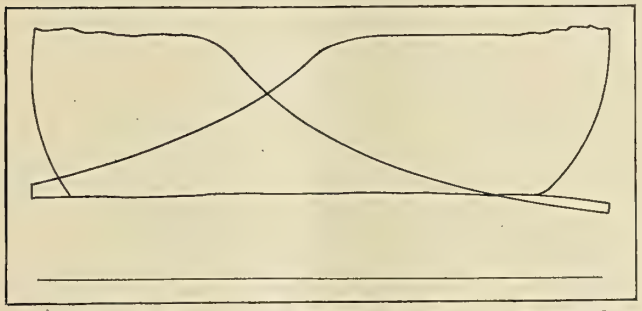
A spare cylinder was installed. This, of course, had been fitted with a false seat. This cylinder was properly alined and secured and the valves were refaced and reset.

The expander cylinder was found to be faulty and a new one was installed. The valves were set by a machinist that had been doing this kind of work for years, and his method was not questioned. When the machine

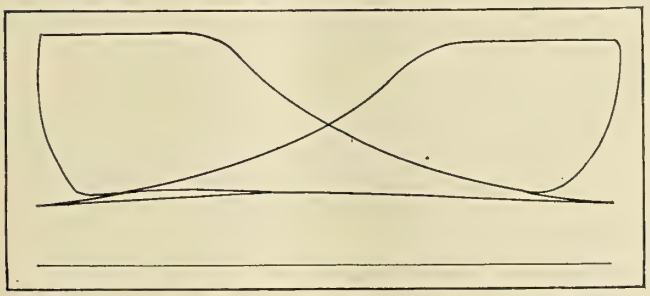
was started, it was found that it did not run steadily, nor did the pressures come right, for the pressure of the compressor would be 250 pounds; but, then, the pressure on the expander would mount to 83 and sometimes to 85 pounds. Now this would not do, for the temperatures would not be low enough in the tropics, so close observations were made, and it was noticed that the leathers would wear very quickly in the expander, and it was first blamed to that. Later as the ship was in cooler weather and the injection water was down to 54 to 64 degrees, time was taken to experiment, as the temperatures of



Card No 1: Compression, 235 Pounds; Exhaust, 72 Pounds



Card No. 2: Compression, 250 Pounds; Exhaust, 80 Pounds



Card No. 3: Compression, 252 Pounds; Exhaust, 64 Pounds

storage were low enough to allow the shutting down of the machine for a few hours.

As the expander pressure was never lower than 81 pounds, even when the leathers were new and the compressor pressure was up to 250, the trouble was to be looked for and found in the expander cut-off valve. The cover was removed and the setting of the valve determined and found to be 5¾ inches on the crank end and on the head end it was 3⅞ inches, which caused it to run erratically. The stroke of the piston was 14 inches.

The machinist was not questioned in regard to the setting of the valves, as he had had years of experience in that line, but it is doubtful if he ever had to run one after he had overhauled it.

The expander valve was taken out and a piece of metal ⅛ inch was fastened to one end of the valve, and this was put in place, splitting the difference in length when setting.

The bonnet was replaced and the machine started, but the result was not as great as was expected, for the expander pressure did not come below 78 pounds, and this was not considered low enough, so other changes had to be made.

Thinking that indicator cards would be a good guide in finding the fault, although the machine was not rigged for taking cards, the following method was adopted in rigging up. An indicator fitting was placed on the drain or blow line of the expander cylinder. A reducing motion was made consisting of a double diameter drum, one having a circumference of 14 inches and the other of 4 inches. This was placed in line with the crosshead of the expander and a small bracket was placed on the crosshead to attach the cord. As there was no means to take the return motion, a spring was attached to the small drum to return the drum on the return stroke of the piston.

All these preparations were made during the times when the machine was shut down, so no time was lost, and when all was ready a set of cards was taken with pressures as given, the compressor 235 pounds and expander 72 pounds, as shown on card No. 1. Card No. 2 was taken at a compressor pressure of 250 pounds and expander pressure at 80 pounds. The revolutions per minute were not taken, nor was any attempt made to find the indicated horsepower, as we were going to find and remedy the trouble first.

Having taken all measurements of the valve, I considered that I would build a valve somewhat longer and install it as time could be found. This valve was made ⅝ inch longer than the one that had been installed. As soon as it was finished it was installed, and again cards were taken, the compressor pressure being 252 pounds and the expander pressure 64 pounds, showing that almost 4 expansions were obtained. This card is marked No. 3. This was considered as being an extraordinary card, as it had perfect lines; in fact, the best card that I have ever seen.

The setting of the valve was done in the following manner: The valve was put on the stem and put in nearly the right position, then the machine was jacked over and cut-off taken at each end. Next it was found that the cut-off, if evenly divided, would take place at 3⅞ inches from each end where it was firmly set and bonnets put on and connections made and the machine started and when the pressures were up to working point, card No. 3 was taken and the results were so good that no further steps were taken to improve it.

The temperatures in the cold storage rooms were found to be lower than formerly and resulted in running the machine only 12 hours a day, as the temperatures were low enough to warrant the shutting down of the machine.

The cold storage rooms are three in number, and are of the following capacity—1,300 cubic feet, 338 cubic feet and 253 cubic feet. The first has a cooling surface of 540 square feet, the second 113 square feet, the third 102 square feet.

The maximum temperature in these rooms has not been over 31 degrees and the minimum temperature has been as low as 14 degrees above zero, that is, the machine has been holding the temperatures down besides freezing over 400 pounds of ice in twelve hours daily.

Full data cannot be furnished till more thermometers are fitted, as then a more careful chart will be made out and the results will be sent in so that the readers of this article will be able to understand the benefit which was derived from the change in valves.

It has now been nearly two months since this change

has been made and the leathers have been renewed only once in the expander and the leathers in the compressor have not been renewed during that time and seem to be in good order, as the compressor pressure is maintained at 252 to 255 pounds at all times. The primer pump is more than ample to make up for the leakage of the valve stems as the relief valve on the primer line would lift every stroke if the stuffing box were set up on so the packing would not leak. The result of having a loose set of packing has made such an improvement that the primer has not been repacked during the last two months and even now is run rather loose.

The cards have not been worked out, as it has not been deemed necessary, for the work that is being done is what we were after.

Another thing that has been done on this machine is that a valve and a check have been placed on the primer line between the compressor intake, so that should the primer pump at any time go wrong the globe valve on the line would be closed and the machine could be run while the primer pump valves were looked at. At one time when an attempt was made to clean the place up a small piece of waste entered into the primer and that time it saved the shutting down of the machine, for if this valve had not been installed the machine would have had to have been shut down while the valve head of the primer pump was off for overhaul.

Now, it must be understood, that all this did not happen in one month as this report covers almost 18 months, but the knowledge gained is worth all the trouble that has been encountered. If any reader has had any better results I would gladly read his experiences.

F. C. W.

The Steam Turbine on Board Ship

(*Continued from page* 340.)

The gear and pinions are lubricated by oil sprays projected against the line of contact of the gear teeth on the entering side. The oiling device can be examined and cleaned conveniently, without lifting the gear case cover or disturbing any of the other parts.

Great care is given to the question of accessibility, as this is of extreme importance in marine work. All gear reductions are designed to be readily accessible in all parts, and all parts entering into the construction are built on a limit-gage, interchangeable basis, insuring perfect fit of spare parts.

The De Laval Steam Turbine Company is also prepared to furnish steam turbines for ship propulsion in any capacity required and to meet any steam conditions. Large numbers of steam turbine-driven auxiliaries have been supplied in the last few months to shipbuilding companies for installation on shipboard, such as turbine and motor-driven centrifugal boiler feed pumps, auxiliary lighting sets and circulating pumps.

In connection with the latter, attention is drawn to the great advantage of using turbine-driven geared circulating pumps, as the reduction gear permits both turbine and pump to operate at their most efficient speeds, resulting in a very high overall efficiency. Fig. 3 shows a turbine-driven circulating pump designed to handle 5,500 gallons per minute against a head of 25 feet; the turbine operating on a steam pressure of 200 pounds and exhausting into a feed water heater against 6 pounds back pressure. These auxiliary units are all of small and compact design and are an ideal type of auxiliary for installation on shipboard.

Where the electric power required is much as on battleships, passenger boats, etc., many advantages are gained by using standard speed direct-current generators, driven by geared steam turbines. Fig. 5 shows a unit of this type, consisting of a De Laval geared turbine driving a 300-kilowatt, direct-current generator. Two units of this type were supplied for the United States battleship *Arizona*. The generator is of the standard slow-speed type, with which all engineers are familiar, and the turbine is designed to run at its most efficient speed, giving a high overall efficiency and a stable, reliable unit, which qualities are not possessed by directly connected, high-speed, direct-current generating sets, particularly in the larger capacities.

Where the auxiliaries are small and few in number, their steam consumption is often more or less immaterial, since all of the auxiliary exhaust can be employed in heating the boiler feed water, thus returning to the boiler all heat represented by the steam consumed by the auxiliaries, except a small portion lost in radiation and converted into power. Where the amount of exhaust is larger, however, it can either be turned into an intermediate stage of the main turbine, or can be exhausted to the condenser. The fact that the exhaust is entirely free from oil gives a turbine-driven unit a marked advantage over the old-style reciprocating auxiliaries, which constitute a continual menace to the boiler by reason of a relatively large oil consumption.

SHIPBUILDING IN ITALY.—During the year 1915 the only steam vessels of importance turned out from Italian shipyards were the *Giuseppe Verdi* of 9,974 gross tons, built at Riva Trigoso by the Esercizio Bacini for the Transatlantica Italiana Company, the *Citta di Tripoli*, of 3,950 gross tons, and the *Citta di Trieste*, of 4,450 gross tons, built by the Cantieri Navali Riuniti, the first at Ancona and the second at Palermo for the Sicilia Company. At the end of the year there were 25 steel steamships under construction in Italian shipyards, aggregating 102,670 gross tons, of which 14 were over 2,000 gross tons each.

SHIPBUILDING IN MAY.—The Bureau of Navigation, Department of Commerce, reports 114 sailing, steam, gas and unrigged vessels of 61,881 gross tons built in the United States and officially numbered during the month of May. Fourteen of these vessels, of 51,656 gross tons, were steel steamships.

NEW YORK AND BOSTON BOATS USING THE CAPE COD CANAL.—Since June 1 the Metropolitan Line steamers *Massachusetts* and *Bunker Hill* have been making their daily trips between New York and Boston through the Cape Cod Canal. Over this route the length of the voyage is shortened by 77 miles and the time by one and a half hours.

SCHOOL FOR TRAINING NAVAL OFFICERS FOR SUBMARINE SERVICE.—A new school for the instruction of naval officers in the theory and practice of submarine operations has been established at New London, Conn., by the Secretary of the Navy. The first class of officers will report July 1 for six months' training before they are assigned to duty on submarine boats.

SHIPBUILDING IN NORWAY.—The two largest shipyards in Stavanger, Norway, completed during 1915 six steamers of 3,100 tons. The output for the whole of Norway in 1915 was 55 steamers of 45,999 tons. Extensive alterations are now under way in the shipyards which will make it possible for vessels of much larger tonnages to be built and repaired.

Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding will be Answered in this Department

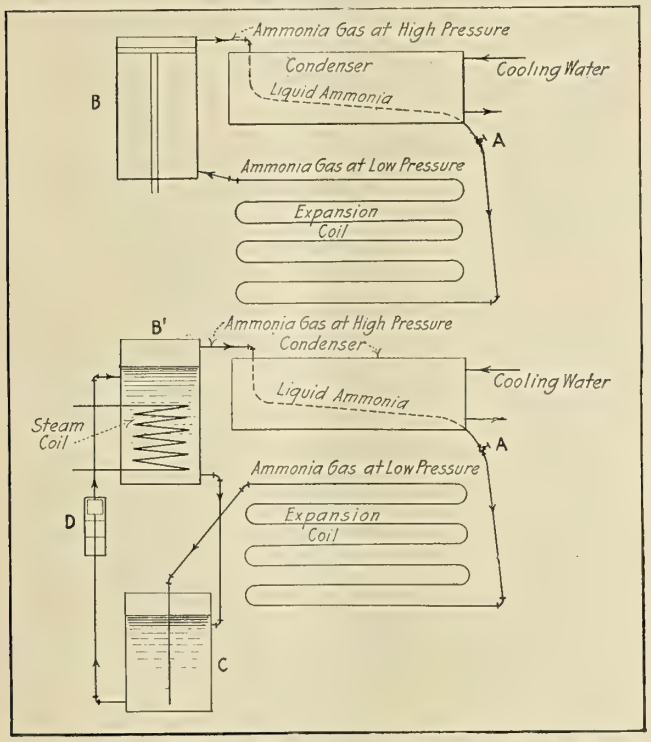
CONDUCTED BY H. A. EVERETT *

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so. Indicator cards taken from marine engines will be carefully analyzed, and defects pointed out, and the horsepower calculated, provided complete data are sent with the cards.

Difference Between Compression and Absorption Ammonia Refrigerating Systems

Q.—Will you please explain to me the difference between a compression and an absorption refrigerating system if both use ammonia? Does the absorption of a gas take up heat the same as evaporation? A. M.

A.—There is no difference in the fundamental principle of both systems. Each derives its refrigerating capability by utilizing the characteristic property of a vapor called heat of vaporization, or latent heat. Each is arranged to produce a vaporization of the liquid into vapor at a place



A, Expansion Valve; B. Compressor; B′ Generator; C, Absorber; D, Pump for Liquid

where the latent heat for this vaporization is absorbed from the space it is desired to cool. Each takes the vapor at a low pressure and temperature and by doing work upon it delivers it at higher pressure and temperature to a condenser, which transforms it into the liquid state, in which condition it passes to the vaporizing chamber. The difference is in the manner in which the work is performed on the ammonia and the method of maintaining the high and low pressures necessary for the liquefaction and evaporation respectively. In the compression machine this pressure difference is maintained by a mechanical unit (the compressor), in the absorption machine the high pressure is supplied by boiling a rich solution of ammonia in water which gives off ammonia gas at high pressure and the low pressure is maintained by absorption of the gas by water in place of the suction of the compressor. The absorption of ammonia by water does not take up heat. On the contrary, it generates heat and the absorption chamber in machines of this type is cooled by water coils. Absorption machines simply minimize the number of moving parts in a compression system and by using the waste heat from other machines as the supply for the steam coils which boil the rich ammonia liquor, then economy is in many cases excellent.

Amount of Material Necessary to Sheath a Boat

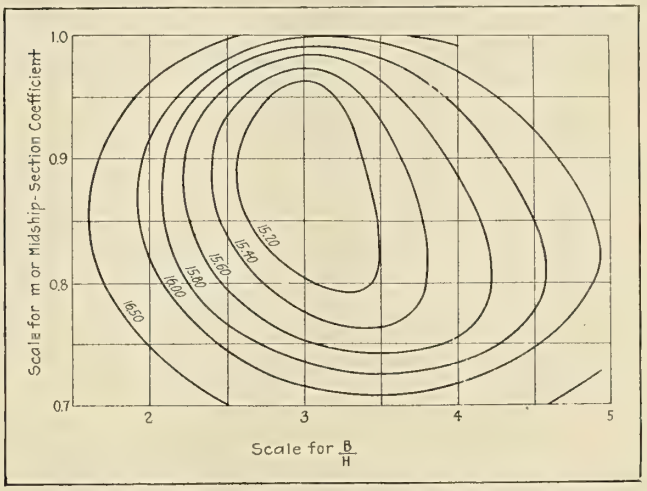
Q.—Can you give us a rule or general information as to how to estimate the number of sheets of yellow metal required to sheath a boat when only length, beam and draft or depth of hold are given?

We have lately had a number of foreign inquiries of this character and there is a wide difference in estimates that have been received as to quantity required. In fact, in some cases it is double the amount estimated in other cases.

We realize that the shape of the bottom of the boat must be allowed for, and therefore the amount required cannot be accurately figured without a drawing, but we wish to quote on enough material so that there will not be a sheet or two short, and at the same time not send a double supply. One inquiry from South America gives us the length of boat as 60 feet, the beam 12 feet, depth of hold 6 feet. We estimate the draft at about 3 feet to 3 feet 6 inches.

Any suggestions as to general rule covering this question will be very much appreciated. SHIPBUILDER.

A.—The best method of determining the amount of material necessary to sheath a boat is to estimate the wetted



Contour Curves of Wetted Surface Coefficient on Midship Section Coefficient and $\frac{B}{H}$

surface and to make such allowance over this as will allow for waste in fitting, overlap of seams, appendages, etc.

Provided the boat has a form that is reasonably ship-shaped, the following formula, due to Naval Constructor D. W. Taylor, U. S. N., and published in his "Speed and Power of Ships," gives the closest estimate of wetted surface. To this must be added the surfaces of the keel, rudder and various appendages, and to the total thus obtained the proper allowance must be made to allow for overlap and wastage.

Wetted surface $= C\sqrt{D \times L}$.

Wetted surface in square feet:

* Professor of Marine Engineering, Post Graduate Department, United States Naval Academy, Annapolis, Md.

D = Displacement in tons (total weight of boat).
L = Length at load waterline in feet.
C = Constant taken from figure accompanying, in which
B = Beam at low waterline in feet.
H = Draft (molded) in feet.

$$m = \text{Midship section coefficient} = \frac{\text{Area Midship}}{B \times H}$$

For the case mentioned, if we assume a block coefficient of .79, the displacement is

$$\frac{60 \times 12 \times 3 \times .79}{35} = 48.8 \text{ tons} = D.$$

Estimating the midship section coefficient to be about .80 = m, we get the value of C from the plot to be

$$15.5 \left(\text{at } m = .80 \text{ and } \frac{B}{H} = 4\right)$$

then

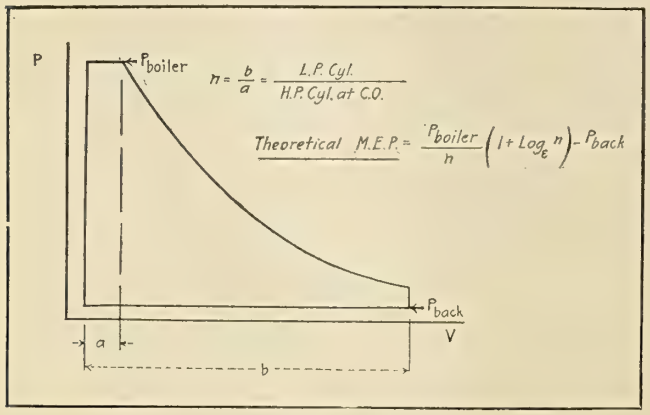
$$\text{Wetted surface} = 15.5 \sqrt{48.8 \times 60} = 839 \text{ square feet}$$

Allowing 20 percent for rudder and appendages, gives a total wetted surface of 858 square feet, which is to be increased by the necessary allowance for wastage and fitting. For rough estimations the value of 15.5 for the constant C covers most cases, though for broad boats and shallow draft boats with sharp bilges a higher value would be preferable, say 16 or 16.5 in extreme cases.

Indicator Cards for Triple Expansion Engine

Q.—A short time ago I was before a local board of steamboat inspectors, taking an examination for an engineer's license, and among other questions was asked to draw a set of cards presumably taken from a triple expansion engine. I was to furnish all the data myself; that is, diameter of cylinders, stroke, steam pressure, etc., and work up the cards to correspond to these data. I should greatly appreciate any suggestion or help you can give me in answering a question of this sort. OILER.

A.—The question is rather indefinite and its exact purpose difficult to conjecture, but probably it was intended to do one of two things: either to test the applicant's



Sketch of Card

memory and sense of the general proportions and characteristics of a triple expansion engine and its diagrams, or it was intended to determine his knowledge of the principles of engine design. For the first, data of any specific installation should be sufficient. If the second were wanted the answer might be as follows:

Assume a boiler pressure, vacuum, piston speed, cylinder ratios, and either revolutions per minute or stroke, then solve for the proper size of cylinders to give the horsepower desired and sketch the cards each with the proper area and mean effective pressure. For example, let us take the design of a three-cylinder, triple expansion engine to develop 1,800 indicated horsepower with a boiler pressure of 180 pounds gage, vacuum of 27 inches (which would give about 4 pounds back pressure in the low pressure cylinder), piston speed of 630 feet per minute and a stroke of 42 inches. Reasonable cylinder ratios would be 7.1 for low pressure to high pressure and 2.8 for intermediate to high pressure and with cut-off at three-quarters stroke. The solution for the low pressure cylinder diameter could be made as follows, and from it the diameters of the others would be found directly from the cylinder ratios assumed.

The expression for indicated horsepower is

$$I.H.P. = \frac{2PLAN}{33{,}000}.$$

Where P is the mean effective pressure referred to the low pressure cylinder,
L is the length of the stroke in inches,
A is the area of the low pressure cylinder,
N is the number of revolutions per minute.

All of these are known except A and P, so if a reasonable value can be estimated for P the area A can be determined at once. For engines of this type about 65 percent of the power that would be developed, if the expansion in the cylinder were hyperbolic, is realized. Hyperbolic expansion for this case would give a *theoretical*

$$M.E.P. = P_{\text{boiler}} \times \frac{1}{n}(1 + \text{Log}_e\, n) - P_{\text{back}}$$

P = pressure in pounds per square inch

$$n = \frac{\text{Vol. L. P. Cyl.}}{\text{Vol. H. P. Cyl. at } C.O.}$$

$n = \frac{7.1}{.75} = 9.48$. *Probable* M. E. P. = .65 × theoret. M.E.P.

$$= .65\left(\frac{194.7}{9.48}(1 + 2.249) - 4.0\right) = 40.8 \text{ pounds per sq. in.}$$

then since

$$2LN = \text{piston speed, } 1800 = \frac{630 \times 40.8 \times A}{33{,}000}.$$

$L.P.A. = 2313$ square inches
$L.P.$ diameter $= 54\frac{1}{4}$ inches.

As the areas are proportional to the squares of the diameters the sizes of the intermediate and high pressure cylinders are determined directly from the assumed cylinder ratios and are

$H.P.A. = \frac{2313}{7.1} = 325$ sq. ins. Diameter $= 20\frac{3}{8}$ ins.

$I.P.A. = 325 \times 2.8 = 901$ sq. ins. Diameter $= 33\frac{7}{8}$ ins.

If the assumption is made that the work is equally distributed between the cylinders, which is not far from true if the cylinder ratios are well chosen, then the proper mean effective pressure and areas for the cards for all cylinders are known and cards sketched in accordance.

Definition of "Inverted" as Applied to Marine Engines

Q.—Can you tell me why it is that in descriptions of modern marine engines they refer to them as "three-cylinder, triple-expansion, vertical, *inverted*, etc."? I can see a reason for all the adjectives except the *inverted*, and must confess that I can see no "rhyme or reason" for that. If you can enlighten me, I shall be much obliged and will pass it along to others who, I know, are in the same fix. L. O. D.

A.—The adjective "inverted" when used in describing the present type of marine engine is superfluous and is simply an historical relic of the days when the walking-beam engine driving side paddle wheels was the common type. This engine had its cylinder in the bottom of the ship with the piston rod, crosshead, etc., above it and when the first engines of the present type driving propellers came out they were called "inverted," a term which has survived even to the present day, though rapidly becoming obsolete.

Shipbuilding and General Marine News

Contracts for New Ships—Marine Terminal Improvements—Recent Launchings—Improved Appliances—Personal Items

Steel merchant vessels building, or under contract to be built, in private American shipyards on June 1, 1916, according to builders' returns to the Bureau of Navigation, Department of Commerce, numbered 372 of 1,147,534 gross tons. The growth during recent months is shown by the following summary of (*a*) vessels building, or under contract to be built, on the first of each month, beginning with February, 1916, (*b*) new contracts during that month, (*c*) vessels completed during that month.

On the 1st of—	Built or Under Contract.		New Contracts.		Vessels Completed.	
	Number	*Gross tons*	*Number*	*Gross tons*	*Number*	*Gross tons*
February	230	901,371	20	61,136	6	31,329
March	244	945,798	107	151,296	5	23,394
April	360	1,067,856	20	51,011	6	12,915
May	368	1,129,014	20	81,470	13	53,840
June	372	1,147,534	....	.....	....	.....
Total	.....	.....	167	344,913	30	121,478

One principal establishment announces that as it is booked to capacity until well into 1918 it does not expect to book any more contracts during 1916. New shipyards just beginning operations furnished most of May's increase.

The demand for shipbuilding plates continues very large, as contracts for new vessels are now under discussion which will require extensive plate and shape tonnages for the last half of 1917 and the early part of 1918. These contracts are to be placed with American shipyards, and confirm the belief that ship construction in this country will increase rather than decrease after the war ends.

Thirty-seven lumber-carrying vessels are under construction, or have been ordered, on the Pacific Coast.

During the past few months contracts for fifteen ships to be built in American yards, valued at about $12,000,000, have been ordered by Hannevig & Johnsen, New York.

Shipbuilding Orders

The Union Iron Works Company, San Francisco, Cal., has received a contract from the Pan-American Petroleum & Transport Company (a new concern which will include the Mexican Petroleum Company, New York, and other oil concerns) to build two oil tank steamers to cost about $2,750,000.

The Union Iron Works Company, San Francisco, Cal., has received a contract from the Huasteca Petroleum Company, New York, to build three more oil tank steamships.

The Fore River Shipbuilding Corporation, Quincy, Mass., has received a contract to build two oil tank steamers for the Huasteca Petroleum Company.

Moore & Scott, San Francisco, Cal., will build one oil tank steamer for the Huasteca Petroleum Company.

The Hanlon Shipbuilding Company, Oakland, Cal., has received an order from Balfour, Guthrie & Company, San Francisco, Cal., to build the largest wooden ship ever constructed on the Pacific Coast. The vessel in question is a five-masted barkentine, and will be 270 feet long.

The Wilmington Iron Works Company, Wilmington, N. C., has received a contract, through Cox & Stevens, naval architects, New York, to build four 220-foot wooden cargo steamers.

Percy & Small, Bath, Me., have received a contract from C. C. Mengel & Bros. Company, Louisville, Ky., to build a second four-masted schooner. This will be a duplicate of the *Charles D. Loveland*, built at the same yard.

It is reported that Capt. W. A. Blake, Baltimore, Md., has placed a contract with a Maine shipyard to build a four-masted wooden schooner.

It is reported that the Submarine Boat Corporation, New York, has received a contract from France covering the construction of ten submarines and 200 speed launches to be built in Canada. The amount of the contract is stated to be $12,700,000.

It is also reported that the Submarine Boat Corporation has a contract with the Italian Government to build six submarines.

Bixby & Clarke, San Francisco, Cal., are stated to have placed a contract with a Pacific Coast shipyard to build a 255-foot wooden steamer.

The Wallace Shipyards, Ltd., North Vancouver, B. C., have received a contract to build three five-masted schooners, 255 feet long, to be equipped with auxiliary oil engines.

Capt. Geo. A. Gilchrist, Belfast, Me., is building a four-masted schooner for George McQuesten Company, East Boston, Mass.

The barge *B. L. Winchell*, belonging to the Gulf Refining Company, New York, is being cut in two by the Johnson Iron Works, New Orleans, La. One-half will be converted into an oil barge at the plant of the Johnson Iron Works; the other half will be towed to the Gulf City Boiler Works at Mobile, Ala., and will also be converted into an oil barge.

C. E. Fulton, Mormon Island, Los Angeles, Cal., is reported to have a contract to build a small steamer.

The Greenport Basin & Construction Company, Greenport, L. I., is building a number of cruisers and high-speed launches, among them being a 39-foot high-speed launch for F. K. Lord, naval architect, New York.

In addition to the large order which the Greenport Basin & Construction Company has executed for the Russian Government, a number of scout cruisers are under construction for a purpose which has not been divulged. The boats are stated to be 52 feet 6 inches long, and to be equipped with two 400-horsepower engines.

It is reported that the Western Dry Dock & Shipbuilding Company, Fort William, Ont., Canada, has received a contract to build two ocean-going freight steamers 251 feet long.

The Hanlon Dry Dock & Shipbuilding Company, Oakland, Cal., is reported to have received a contract to build a fleet of kelp barges for the Hercules Powder Company.

Shipyard News

The American Shipbuilding Company, Cleveland, Ohio, is planning to build a shipyard at Puget Sound which will admit of the construction of fifteen vessels at one time. It is reported that contracts have already been received to build five vessels at the new yard.

The Wm. Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., has purchased 45 acres of land at Petty's Island on the Delaware River, for the purpose of further enlarging its facilities, and will build a large dry dock there.

The officers of the new shipbuilding yard established at Brunswick, Ga., are H. H. Mason, president; J. R. Lee, vice-president and general manager; L. E. Allen, secretary and treasurer. The company is building a 600-ton schooner, and is reported to have booked several more orders.

The newly-organized Sun Shipbuilding Company, Finance Building Philadelphia, Pa., whose yard is at Chester, Pa., has let contracts for a dozen buildings and six shipbuilding berths. The company is reported to have received orders to build several ships and it expects to lay the first keel in September.

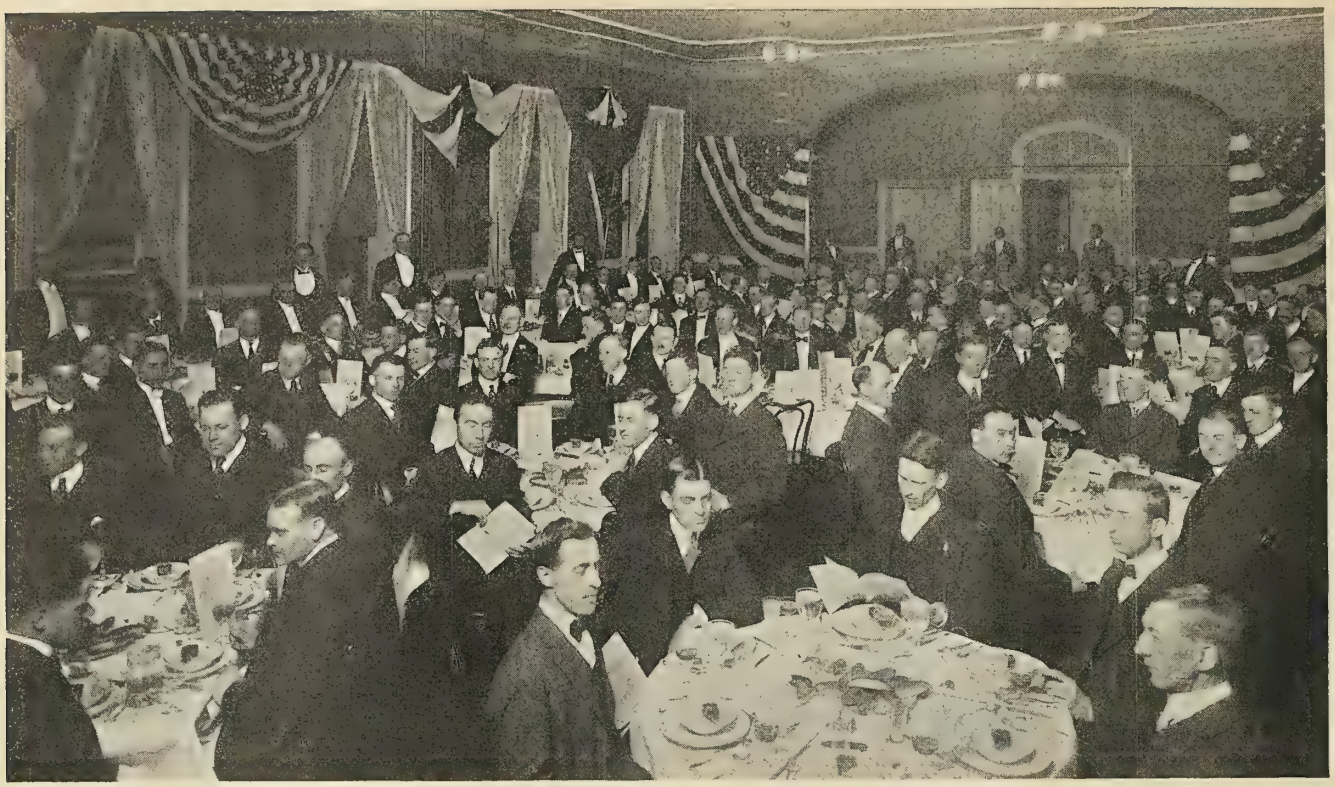
The Coastwise Shipbuilding Company has been organized at Baltimore, Md., by F. A. Brandy, Thomas Whedbee and R. Williams. The company reports that it has already taken orders to build several ships.

The property of the Tietjen & Lang Dry Dock Company, Hoboken, N. J., has been bought by a syndicate headed by Bertron Griscom & Company, New York. The company announces that the property will be managed in future by William H. Todd, president of the Robins Dry Dock & Repair Company, Brooklyn, N. Y.

It is reported that J. H. Thompson, Belfast, Ireland, has interested capitalists with the intention of building a $5,000,000 shipyard in Oakland, Cal.

The Motor Ship Construction Company has been organized at Olympia, Wash., and it is stated that the company has already received contracts to build four lumber schooners.

The San Francisco Bridge Company, San Francisco, Cal.,



Annual Banquet of American Society of Marine Draftsmen at Warwick Hotel, Newport News, Va., April 22

has begun work on the construction of the $2,000,000 dry-dock to be built for the Union Iron Works Company at Hunter's Point. This dock will be able to accommodate ships 1,000 feet long, with 100-foot beam.

It is reported that the plant of Robert Palmer & Son, Noank, Conn., of which the United States Steamship Company, New York, has assumed control, will be equipped for the construction of steam vessels.

The Novia Scotia Steel & Coal Company, New Glasgow, N. S., has begun work on a yard where it is planned to build steel vesels, and is stated to have already received a contract to build a 200-foot steamer.

The Coastwise Shipbuilding Company has purchased a site at the foot of Andre Street, Baltimore, Md., where it is planning to establish a plant to build auxiliary schooners to ply between Baltimore and South America.

The Vancouver Island Marine, Ltd., has been incorporated, with headquarters in Victoria, B. C. Charles J. V. Spratt is at the head of the new company, which is stated to have already received an order to build a four-masted barkentine.

It is reported that a shipbuilding and dry dock company is being organized in Savannah, Ga., with a capitalization of $1,000,000.

The Bulk Oil Transportation Company has been incorporated in Delaware for the purpose of building and operating ships. The incorporators are C. Stewart Lee, Edward Martin and J. Warren Vedder, all of Wilmington.

The Peninsula Shipbuilding Company has been organized at Portland, Ore., by F. C. Knapp, W. M. Ladd, A. L. Mills, A. C. Ainsworth, T. B. Wilcox and Peter Autzen, all of Portland.

New Steamship Companies

A new steamship company, to operate passenger and freight steamers between Boston and New York, has been planned. Albert M. Beers, Newton, Mass., has been appointed manager.

The Lutz Shipping Company has been incorporated, with headquarters at Pensacola, Fla. E. Lutz is president; John A. Merritt, vice-president; R. H. Turner, secretary-treasurer.

The Wilmore Steamship Company has been organized, with a capital of $1,800,000, by John E. & E. J. Berwind, New York.

The Franklin Baker Shipping Company has been incorporated, with a capital stock of $100,000, to engage in the shipbuilding and operating trade. The company has been organized entirely by the Franklin Baker Company, Philadelphia, Pa.

The Vinegar Bend Lumber Company, Mobile, Ala., is planning to operate a barge line between Mobile and Cuba, and orders have already been placed for several ocean-going lumber barges.

The Southland Steamship Company, capital $5,000,000, has been organized at Savannah, Ga., by George P. Walker, Frank D. N. Strachen, George F. Armstrong and others, and is stated to have given the Union Iron Works, San Francisco, Cal., a contract to build a $1,000,000 steamship.

Marine Terminal Improvements

The Chicago, Milwaukee & St. Paul Railway Company, St. Paul, Minn., is improving its ocean terminals at Tacoma, Wash., and is planning to spend $500,000 on the work.

A. Webster, Director of the Department of Wharves, Docks and Ferries, Philadelphia, Pa., has had plans drawn for the construction of several piers. The estimated cost is $4,000,000.

The Canton Company, Commerce and Water streets, Baltimore, Md., is having a 600-foot pier built at Canton, Baltimore, Md.

The Healey-Tibbets Construction Company, San Francisco, Cal., has received a contract to build an addition to Pier 38, San Francisco.

E. L. Gorham, city engineer, Lake Charles, La., has prepared plans for a municipal wharf.

The Wilmington Steamboat Company, Wilmington, Del., has given a contract to William D. Haddock & Company, Wilmington, to build a wharf and shed.

J. F. Duthie & Company, Seattle, Wash., are planning to build a $200,000 dry dock. William T. Donnelly, 17 Battery Place, New York, is the engineer.

George Cromwell, city engineer, Ocean Beach, Cal., is planning the construction of two freight piers.

Dock Commissioner R. A. C. Smith, Pier A, New York, has drawn plans for repairing the pier at the foot of West Fifty-fifth street, North River, and to construct a freight shed and make other improvements.

The city of New Haven, Conn., is planning a bond issue of $250,000 for the extension of the New Haven Public Wharf. Address Charles E. Julin, secretary of the Chamber of Commerce.

The city of Selma, Ala., will build a wharf of stone and concrete construction.

MARINE ARTICLES IN THE ENGINEERING PRESS

Beam and Draft of Warships.—Editorial discussion of a series of experiments carried out in the Washington experimental basin by Rear Admiral D. W. Taylor, showing that in battleships it is not only possible to have a reduced power with increase of beam on account of a finer block cofficient, but that in some cases there may be a gain due to the adoption of a more suitable longitudinal coefficient. 1,200 words.—*The Engineer,* May 12.

An Experimental Tank Reproducing Wave Motion.—By Col. G. Russo, R. I. N. Abstract of paper read before the Institution of Naval Architects on April 12. 6 illustrations. 3,800 words.—*Engineering,* May 12.

The Position of the British Merchant Fleet.—Editorial article urging definite action for maintaining the over-sea carrying capacity of the British merchant fleet. 1,300 words. —*Engineering,* May 12.

U. S. S. Oklahoma.—By Henderson B. Gregory. Detailed description of the battleship *Oklahoma* of 27,500 tons displacement and 20.5 knots designed speed, built by the New York Shipbuilding Company, Camden, N. J., for the United States navy. 3 illustrations. 12,000 words.—*Journal of the American Society of Naval Engineers,* May.

Testing of Metals at the Engineering Experiment Station.—By D. J. McAdam, Jr. Descriptions of methods employed at the Naval Engineering Experiment Station for the metallographic examination and physical testing of metals. 15 illustrations. 2,800 words.—*Journal of the American Society of Naval Engineers,* May.

U. S. S. Conyngham.—By Lieut. H. H. Norton, U. S. N. Detailed description of the torpedo boat destroyer *Conyngham,* of 1,090 tons displacement and 29½ knots speed, built by the William Cramp & Sons Ship & Engine Building Company, Philadelphia, Pa., for the United States navy. 2 illustrations. 4,800 words.—*Journal of the American Society of Naval Engineers,* May.

The Industrial and Strategical Importance of our Naval Stations.—By Rear Admiral John R. Edwards, U. S. N., retired. A discussion of the value of the United States Naval Stations in relation to the maintenance and upkeep of the navy, and a plea for better preparedness in this arm of national defense. 24,000 words.—*Journal of the Society of Naval Engineers,* May.

An Alternating-Current System for Engine Telegraph, Helm-Angle Indicators, Etc.—By Leonard A. Doggett. Description of the two general principles for interior signaling systems on board ship, and suggestions for the development of small instruments to indicate helm-angle and position of turrets and the application of such instruments for searchlight control. 9 illustrations. 2,000 words.—*Journal of the American Society of Naval Engineers,* May.

The Firing and Combustion of Soft Coal Under Naval Boilers.—By William L. De Baufre. Information based on experience in testing coals by burning fuel on navy standard grates under navy boilers at the United States Naval Engineering Experiment Station. Recommendations for obtaining the most economical results from combustion under these conditions. 1 illustration. 4,500 words.—*Journal of the American Society of Naval Engineers,* May.

The Fractional Distillation of Lubricating Oils.—By J. G. O'Neil. Description and results of an investigation made to devise a fractional distillation method for separating a mineral oil into its component light oils, intermediate oils and heavy oils, and to investigate the properties of these light, medium and heavy oils. 7 illustrations. 7,200 words.—*Journal of the American Society of Naval Engineers,* May.

Submarine Engines of the German Navy.—By Lieut. C. W. Nimitz, U. S. N. Description of the Augsburg, Nuremberg and Krupp (two-cycle) types of Diesel engines. 4 illustrations.—4,200 words.—*Journal of the American Society of Naval Engineers,* May.

U. S. S. Jacob Jones.—By W. F. Sicard. Detailed description of torpedo boat destroyer *Jacob Jones,* of 1,090 tons displacement and 29½ knots' speed, built by the New York Shipbuilding Company, Camden, N. J., for the United States navy. 2 illustrations. 6,800 words.—*Journal of the American Society of Naval Engineers,* May.

Analysis of Stresses in Connecting Rods.—By Lieut. Karl F. Smith, U. S. N. Mathematical discussion showing that the stresses deduced by the formulæ for connecting rods now in general use are misleading, and give results much below the actual stresses in the rod. 7 illustrations. 5,000 words.—*Journal of the American Society of Naval Engineers,* May.

Lighterage.—By Henry L. Joyce, manager, Marine Department, Central Railroad of New Jersey. Paper read before the New York Railroad Club on May 19, showing the development of the present great lighterage system operated in New York harbor. Brief description of the barges, carfloats, hoisting derricks, grain elevators, etc., used in this service. 4,000 words.—*Transactions of the New York Railroad Club,* 1916.

The Ljunström Turbine and Its Application to Marine Propulsion.—By Roland S. Portham. Paper describing the development of electric propulsion, with detailed description of the Ljunström turbine and its application with electricity and mechanical reduction gears to the propulsion of vessels. 25 illustrations. 8,000 words.—*Transactions of the Institution of Engineers and Shipbuilders in Scotland,* April.

Shaft Calibration.—By William H. Carter. Description of calibrating device, torsion indicator and calibrating test for determining the relation existing between the angle of twist and the horsepower transmitted by a shaft. Formulæ and results deduced. 1 table. 4 illustrations. 2,500 words.—*The Journal of the American Society of Marine Draftsmen,* April.

The Merchant Marine.—By Capt. William G. Randle. General review of the past success, the present condition and the future prospects of the shipping interests of the United States in comparison with those of the other nations of the world, with a plea for the application of a portion of the nation's wealth to the building of a navy and to the advancement of the interests of a great mercantile fleet. 3,000 words.—*The Journal of the American Society of Marine Draftsmen,* April.

Marine Steam Turbine Machinery.—By E. H. B. Anderson. Critical discussion of several papers read before the International Engineering Congress at San Francisco in 1915, with comparisons of reciprocating engine, turbo-electric and geared turbine systems of propulsion. 2 illustrations. 3,500 words.—*The Journal of the American Society of Marine Draftsmen,* April.

PERSONAL

Edward B. Hill has been elected secretary and treasurer of the Fore River Shipbuilding Corporation, Quincy, Mass., succeeding the late Joseph A. Sedgwick.

Christoffer Hannevig, of New York, has been elected president of the Pusey & Jones Company, Wilmington, Del., vice Stirling H. Thomas, resigned.

James M. Bullowa, of New York, has been elected secretary of the Pusey & Jones Company, Wilmington, Del.

Henry Lysholm, of Philadelphia, has been elected vice-president of the Pusey & Jones Company, Wilmington, Del., vice Elbert H. Nesse, resigned.

H. E. Norbom, of Philadelphia, has been elected treasurer of the Pusey & Jones Company, Wilmington, Del.

C. Stewart Lee has been elected assistant to the president of the Pusey & Jones Company, Wilmington, Del.

Samuel Holmes, for over thirty-seven years prominently identified with the ship brokerage business in New York, has retired, and his business has been taken over by the Continental Trading Company of New York.

Dr. Joseph Struthers, formerly secretary of the American Institute of Mining Engineers, has become treasurer of the Federal Export Corporation and the Federal Shipping Company, Inc., New York.

Chauncey G. Whiton, for many years general agent of the New Bedford, Martha's Vineyard and Nantucket Steamboat Company, New Bedford, Mass., has recently acquired the managing interest in the New Bedford Towboat Company.

OBITUARY

Capt. Jared Gaines, well known as a former commander of Atlantic coastwise steamers, died recently at his home in Glastonbury, Conn., aged 69.

John S. Keen, for over thirty years master shipwright at the Cramp's shipyard in Philadelphia, died recently at his home in Philadelphia, aged 65.

Capt. Walter Baxter, late commodore of the Anchor Line fleet, and for over thirty years in the service of the Anchor Line, died recently at his home in Glasgow, aged 64.

Capt. Frederick W. H. Murrell, famous as the rescuer of the 733 passengers and crew of the steamer *Danmark* in 1889, died on June 9 in Baltimore, aged 54 years.

ENGINEERING SPECIALTIES

Q. M. S. Cold Metal Sawing Machine

In the Q M S cold metal sawing machine, illustrated, which has recently been placed on the market by the Vulcan Engineering Sales Company, Chicago, Ill., the saw and gear arbor, are of hammered open-hearth .60 carbon steel. The teeth are cut from the solid, and being staggered, back lash

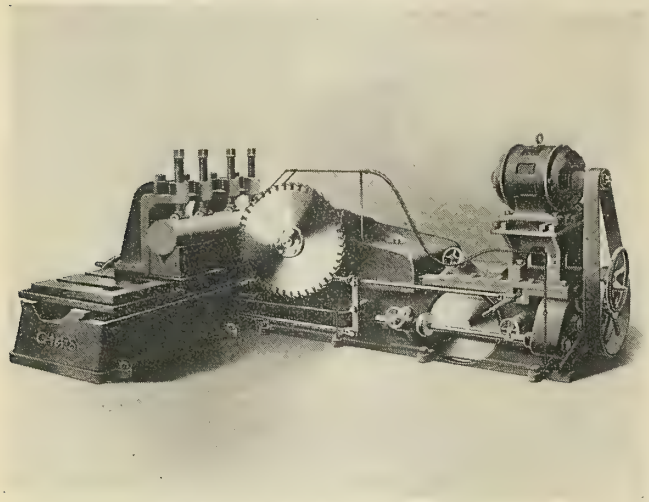


Fig. 1.—Q. M. S. Cold Metal Saw

and resultant chatter of the saw blade is reduced to a minimum. The main drive is through a worm and worm wheel, both encased and run in grease. Roller bearings take the end thrust of the worm. The carriage is of box section, with full-length bearing and hand adjustment, automatic stop and quick power return. Feed is accomplished by a combination

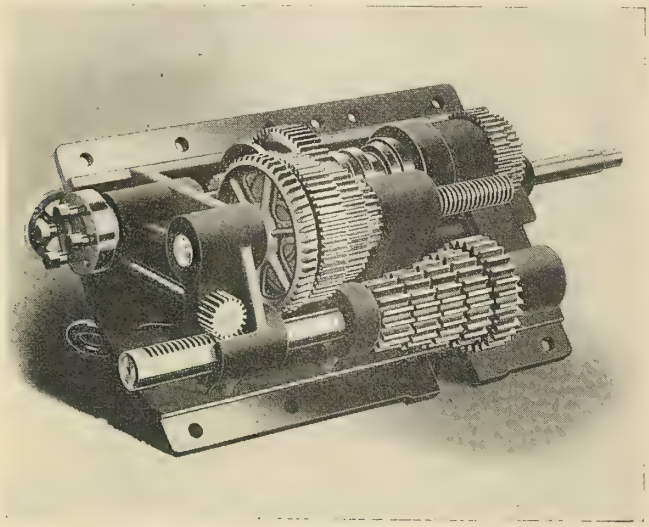


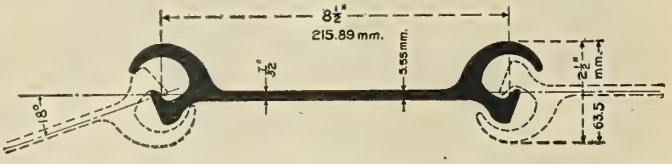
Fig. 2.—Gearing

of a friction disk and gears, providing a range of from 5/16 to 2½ inches per minute. The peripheral speed change is instantaneous, being arranged to run at either 30 and 50 or 40 and 60 feet per minute as desired. All of the gears run in oil, and the internal bearings are lubricated by oil pipes leading to the exterior of the machine.

A New Section of Lackawanna Straight Web Steel Sheet Piling

The new Lackawanna 8½-inch section, of which the illustration and table of properties are shown on this page, was designed to give a wider range of selection to users of Lackawanna steel sheet piling. This new section is of the standard Lackawanna straight-web type with interlock, consisting of similar hooks and guards on both edges, and is for use where a comparatively light section is required with high transverse strength and minimum weight, in medium trench and cofferdam work.

The interlock joint, formed between adjacent piles, is flexible through an arc of 18 degrees on each side of the center plane of the piling section. The hooks of adjacent sections engage to offer the greatest resistance to longitudinal displacement, while the guards overlap and engage the outer surface of the hooks on the adjacent sections, thus preventing



WEIGHT.		TRANSVERSE STRENGTH.		MODULUS OF SECTION.	LEAST RADIUS OF GYRATION	REMARKS.
LBS PER SQ. FT.	LBS PER LIN. FT.	PER SINGLE SECTION.	PER INCH OF WIDTH.	AVERAGE SECTION MODULUS PER HORIZONTAL FOOT OF WALL INTERLOCKED IN PLACE.		The efficiency of this pile per pound of metal (considering that the load will be in proportion to its width, also considering its high transverse strength and low weight) is comparatively very high, as can be demonstrated.
20.75	14.698	1.100 In.³	0.1294 In.³	1.553 In.³	0.509 In.	
PER SQ. METER IN KILOGS.	PER LIN. METER IN KILOGS.	PER SINGLE SECTION.	PER CENTIMETER OF WIDTH.	AVERAGE SECTION MODULE PER HORIZONTAL METER OF WALL INTERLOCKED IN PLACE.	LEAST RADIUS OF GYRATION.	
101.314	21.873	18.024 Cm.³	0.835 Cm.³	83.478 Cm.³	1.293 Cm.	

lateral displacement and co-operating to prevent longitudinal displacement. The joint can be disengaged only by withdrawing one pile. There are three lines of contact between the interlocked members of each joint, so that there is a positive, double, firm and close interlock, yet a minimum of friction in driving or withdrawing and ample opportunity for displaced material to work into the joint and assist in rendering it watertight, while at the same time the interlock holds the piling in proper alinement to form the wall.

In the development of this new section, special attention was given to secure for this joint high tensional and transverse strength, and at the same time to produce a pile which would have comparatively low weight per square foot; be simple, interlock perfectly and have the material so distributed as to give a high section modulus per lineal unit of wall.

Lackawanna steel sheet piling is made by the Lackawanna Steel Company, Lackawanna, N. Y.

Hele-Shaw Martineau Electric Hydraulic Steering Gear to be Manufactured in the United States by the American Engineering Company

The American Engineering Company, Philadelphia, Pa., has recently been appointed sole licensees in the United States for the design and manufacture of the Hele-Shaw Martineau electric hydraulic steering gear, manufactured in England by John Hastie & Company, Ltd., at Greenock.

This gear consists essentially of two or more hydraulic cylinders and plungers operating a crosshead attached in some convenient form to the tiller or rudder stock. The operation of these hydraulic plungers to the right or left operates the rudder to starboard or port, as predetermined by the piping and electrical connections. The power for operating the plungers is furnished by a continuous-acting variable stroke pump, driven by an electric motor. Power from the pump to the hydraulic plungers is transmitted through a high-grade oil, which fills the hydraulic cylinders and pipes. The electric motor operating the pump runs continually at a normal speed, but taking automatically only such current as is required to deliver the power which is needed by the pump in its operation.

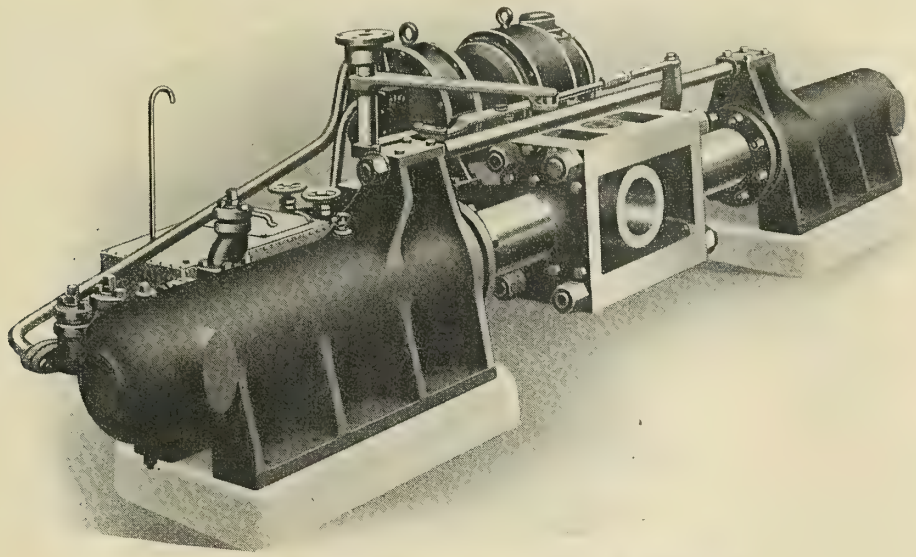
The pump has a sliding head inside of its cylinder, and this is operated so that the direction of the pump is reversed, and the amount of liquid pumped is varied according to the position of this head. With the sliding head in an extreme position (right or left), the maximum flow of liquid is caused, but at a minimum pressure, whereas with the sliding head slightly removed from the central position the amount of liquid delivered is very small, but the pressure is very great, running to the maximum required.

Under usual conditions, the tilting head is operated by an hydraulic telemotor of the standard steering engine type controlled from the pilot house or bridge. Other means of operating the head with equal efficiency may be provided, however, such as by a pilot motor as described in our April issue, or by means of a wire rope transmission or by shafting.

The special advantages claimed for this type of electric steering gear are: (1) absolute reliability; (2) economy in

running costs; (3) extreme sensitiveness and responsiveness to the action of the helmsman; (4) absolute silence when operating; (5) simplicity of construction; (6) economy of space, and (7) durability—minimum of repairs.

As an example of economy, the steamship *Orama,* a vessel of 13,000 tons displacement, which is equipped with this steering gear, cruised 120,000 miles at a speed of approximately 18 knots without any repairs to the gear whatever, and with an average consumption of electrical energy for the steering gear of about 2.4 kilowatts per hour.



Hele-Shaw Martineau Electric Hydraulic Steering Gear

The American licensees of this apparatus are in an especially advantageous position for taking up the manufacture of this type of steering gear, owing to the more than 50 years of experience which they have had in the development and manufacture of steering gears and other auxiliary ship machinery.

Among the many steamship lines in the United States using this device, in addition to the United States navy, are the American-Hawaian, Old Dominion, New York & Porto Rican, Southern Pacific, Mallory, Isthmian, Ward, Pacific, and all of the Standard Oil lines.

Fire Helmet

The United States Government is using on its warships a new fire helmet manufactured by the Maxwell-Hood Manufacturing & Selling Company, New York, as a protection against not only smoke but ammonia and gas fumes. Where smoke or poisonous gases are encountered it is claimed that any inexperienced operator can adjust the helmet at an instant's notice, and thereby assist in saving property, and in many cases loss of life. An operator using this helmet, it is claimed, can remain about ten minutes in any space filled with smoke or deadly fumes with perfect safety, when the helmet can be refilled in a second and is ready for further use. Moreover, with the helmet on, the operator can hear and be heard; and as the helmet is so light and occupies so small space it can be carried in the operator's pocket without difficulty. The helmet is treated by a process which makes it non-inflammable, and with ordinary care it is claimed that it will last from six to eight years in constant use.

Views of the Helmet in Use

Year's Record at Large Japanese Shipyard.—The largest shipbuilding plant in Japan is in Nagasaki. Less than 30,000 workmen are engaged in shipbuilding in the country, and more than 10,000 are employed here. The plant is called the Mitsu Bishi Dockyard & Engine Works, and does an enormous amount of repair work besides building ships. It has docks ranging in length from 350 to 714 feet and a patent slip capable of lifting a vessel up to 1,000 tons gross. It also maintains a salvage steamer of 716 tons with a speed of 12 knots.

The plant was considerably extended last year and still further extensions are planned. The principal ones were: Fitter shop, cast iron surface table of 1,470 square feet, and one 20-ton overhead traveling crane with motor; machine shop, horizontal boring, drilling, facing and studding machine with motor, 20-ton overhead traveling crane with motor, and 12 lathes; turbine shop, pinion hobbing machine; boiler shop, electric welding plant and hydraulic boiler plate bender; pattern shop, 10-ton overhead traveling crane with motor; crane department, 34-ton floating crane; shipbuilding berth, No. 5 shipbuilding berth, 430 feet long and 28 feet broad, and tugboat *Manazuru-Maru,* 181 gross tons.

During last year and this there has been a serious shortage of foreign material. Japanese shipbuilders are greatly handicapped by the necessity of purchasing many requisites from foreign countries. This is especially true of engines, boilers and general fittings for the equipment of steamers. It is true also, but to a smaller extent, of iron and steel construction materials. Such materials are largely made in Japan, but the quantity is altogether inadequate. At present there is an active demand for such products, and particularly for steel sections.

Losses to Merchant Shipping.—According to data compiled by the *Journal of Commerce,* the total losses to merchant shipping arising from the war up to June 1 have been about 1,272 vessels of more than 2,585,362 gross tons. Approximately 57 merchant vessels of all types, having an aggregate gross tonnage of about 116,724, were destroyed during the month of May.

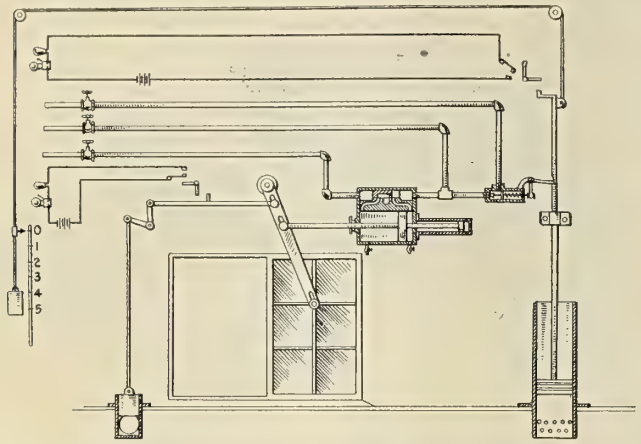
SELECTED MARINE PATENTS

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents, compiled by Delbert H. Decker, Esq., registered patent attorney, Millerton, N. Y.

MECHANISM FOR OPERATING WATERTIGHT BULKHEAD DOORS. JAMES N. PRIEST, KEARSBURG, N. J.

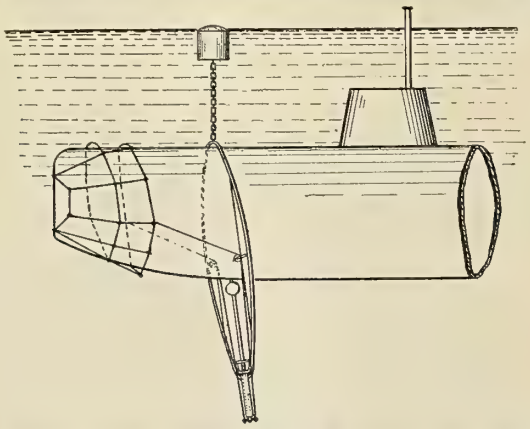
Claim 8.—In combination with a door movably mounted, fluid pressure means for moving the door, a valve for controlling the supply of fluid pressure to the fluid pressure means, a cylinder provided in the



vicinity of its lower end with openings, a float movably mounted in the cylinder, and means operatively connected with the float and the valve for moving the valve in consequence of the movement of the float. Eight claims.

1,173,463. SUBMARINE DESTROYER. JESSE W. RENO, OF NEW YORK, N. Y.

Claim 1.—In a submarine destroyer the combination with a ring and means for supporting said ring in the water, of an explosive bomb secured



to said ring and means connected with said bomb and said ring adapted to explode said bomb when a body enters said ring, said means being inoperative by contact with bodies external to said ring. Six claims.

1,175,483. FREIGHTER. CHARLES R. STEINER, OF NEW YORK, N. Y.

Claim 1.—For combined inland and oversea waterborne freight traffic non-sectional, shallow water freight barges of such standard size and construction as to suit prearranged chambers of sea-going ferryboats with

sea-gates, said barges provided with special reinforcements as will be necessary for them to support their full load in the dry space, each barge on three selected supporting surfaces, which are provided on cushions, fixed on the chamber bottom of the ferryboat; each barge provided with sufficiently strong, perfectly uniting, but promptly releasable coupling devices with contact surfaces, corresponding in distance and size accurately to reciprocal ones on the ferryboat. Two claims.

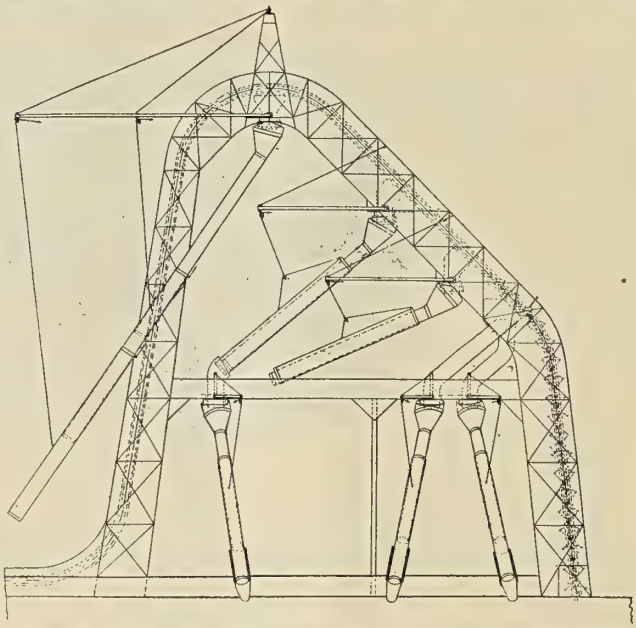
1,173,726. ESCAPE APPARATUS FOR SUBMARINE BOATS. DAVID C. MARSHALL, OF NEWARK N. J.

Claim 1.—An escape apparatus for submarine boats comprising a well connected with the deck of submarine boat, a hatch connected with the bottom of said well and communicating with the interior of said boat, a hatch-plate for normally closing said hatch, a collapsible tubular body providing an escape passage secured by its lower end to said hatch and in communication therewith, said tubular body when collapsed being stowed in said well, a buoy normally confined in said well, flexible connecting means securing said buoy with the free end of said tubular body, a line passing longitudinally through said tubular body, a cover member for normally closing said well, and means for removing said cover member from closed relation to said well operatable from within the interior of said boat. Five claims.

British patents compiled by G. F. Redfern & Co., chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 10 Gray's Inn place, W. C., London.

24,008/14. COAL BUNKERING VESSELS. W. G. READ, OF WHISTON, PRESCOT, LANCASHIRE.

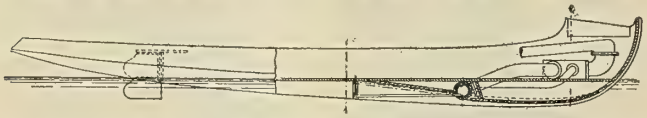
This invention relates to coal bunkering vessels of the kind in which the coal is raised by a bucket conveyor from the hold of the vessel up a tower structure, where the coal is dumped, and descends chutes, which deliver the coal into side ports or hatchways of the vessel which is being coaled. The object is the provision of a coal bunkering vessel capable of delivering coal either by high chutes into hatchways or by



low chutes into side ports, without necessitating for side port work the coal being raised to and dumped from a height much exceeding the height of the side port chutes. Incidentally the invention also enables hatchway-delivering chutes to be employed at different heights to suit the prevailing circumstances, or intermediate chutes to suit either low hatchways or high side ports to be used.

2,298/15. IMPROVED CONSTRUCTION OF VESSELS AND APPARATUS FOR EFFECTING PROPULSION THEREOF. F. W. SCHROEDER, OF 388 KENNINGTON ROAD, LONDON.

This invention relates to an improved construction of vessels and apparatus for effecting propulsion thereof, of that kind in which the propulsion is effected by directing air or other gases under pressure through a series of longitudinal tubes provided under the forepart of the bottom of the vessel, which tubes are provided with orifices or nozzles directed oppositely to the direction of propulsion. The air tubes extend aft from suitable housings arranged transversely to and dis-



posed on either side of the keel. Each housing forms a tube at its inner end with a removable cover at the outer end and is supplied with compressed air by pipes from one or more reservoirs in which the air is maintained at a suitable pressure by means of air pumps driven by petrol motors or other prime movers. An inner tube is fitted into each housing and the arrangements are such that the series of parallel air tubes extending aft and fitted into the inner tube are capable of a certain amount of vertical movement by rotating the inner tube in the housing, by which their inclination to the water surface can be controlled in order to adjust, as may be required, the propelling power of the expelled air on the vessel and consequently the speed of the latter. The arrangement also enables the tubes to be raised in order to prevent any damage which might be occasioned by obstacles in the water.

8,102/15. IMPROVED ATTACHMENT AND RELEASING GEAR FOR BOAT TACKLE. J. BOWDITCH, OF MAITLAND ROAD, ISLINGTON, IN THE STATE OF NEW SOUTH WALES, COMMONWEALTH OF AUSTRALIA.

This invention relates to releasing gear for boat tackle of the kind comprising a pivotally mounted hook adapted to engage a chain-link or the like of the raising and lowering tackle, the hook being held in angagement with said link by a pawl, means being provided for effecting the disengagement of said pawl to permit the opening of the hook. It is usual to place such a device at each end of the boat and to connect the two devices by levers whereby both devices are simultaneously operated. The invention has for its object to provide an improved appliance for the purpose stated affording great facility for instantaneously releasing the boat at the critical moment.